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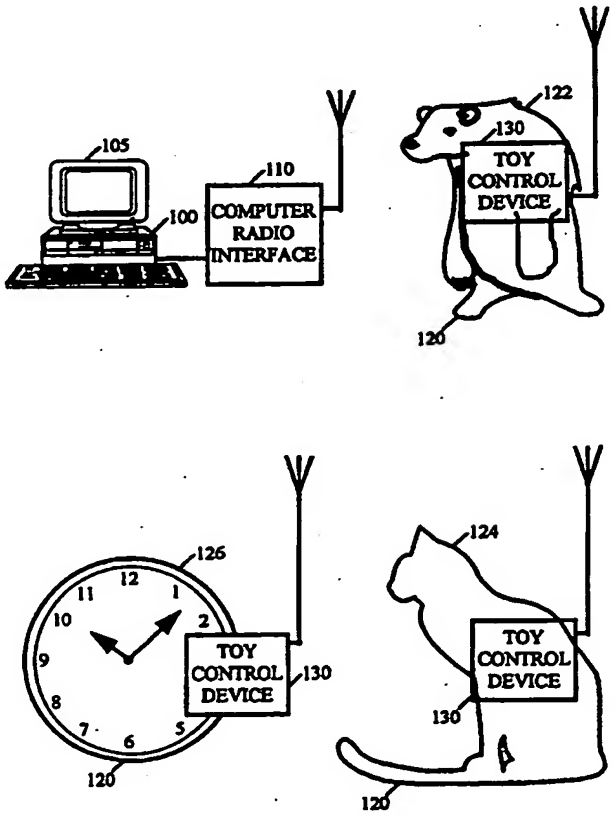
(54) Title: APPARATUS AND METHODS FOR CONTROLLING HOUSEHOLD APPLIANCES

(57) Abstract

A wireless computer (fig. 33, 2100) controlled household appliance system including a first wireless transmitter (2110) and a first wireless receiver (211) and operative to transmit a first transmission via the first wireless transmitter, and at least one household appliance (2122, 2124 and 2126) including a second wireless transmitter (2130) and a second wireless receiver (2130), the household appliance (2122, 2124, 2126) receiving the first transmission via the second wireless receiver and operative to carry out at least one action based on the first transmission, the household appliance (2122, 2124, 2126) being operative to transmit a second transmission via the second wireless transmitter and the computer system (2110) is operative to receive the second transmission via the first wireless receiver.



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APPARATUS AND METHODS FOR CONTROLLING HOUSEHOLD APPLIANCES

FIELD OF THE INVENTION

The present invention relates to household appliances and methods for their operation.

BACKGROUND OF THE INVENTION

United States Patent 5,109,222 to Welty describes a remote control system for control of electrically operable equipment in people occupiable structures which has an essentially unlimited command format. A signal receiving sensor such as an IR sensor receives a signal from a remote control unit, typically hand-held. The IR signal is processed to be compatible with electrically operable equipment such as a sound entertainment system or electrical appliances. A central computer or microprocessor is associated with the dwelling structure and receives a signal from the remote control unit, via the signal receiving sensor. The computer generates a control signal to control the electrically operable equipment. Signals may be sent from the electrically operable equipment through the computer to the remote control unit for providing feedback information to the user of the remote control unit.

Also well known in the art are toys which are remotely controlled by wireless communication and which are not used in conjunction with a computer system. Typically, such toys include vehicles whose motion is controlled by a human user via a remote control device.

US Patent 4,712,184 to Haugerud describes a computer controlled educational toy, the construction of which teaches the user computer terminology and programming and robotic technology. Haugerud describes computer control of a toy via a wired connection,

wherein the user of the computer typically writes a simple program to control movement of a robot.

US Patent 4,840,602 to Rose describes a talking doll responsive to an external signal, in which the doll has a vocabulary stored in digital data in a memory which may be accessed to cause a speech synthesizer in the doll to simulate speech.

US Patent 5,021,878 to Lang describes an animated character system with real-time control.

US Patent 5,142,803 to Lang describes an animated character system with real-time control.

US Patent 5,191,615 to Aldava et al. describes an interrelational audio kinetic entertainment system in which movable and audible toys and other animated devices spaced apart from a television screen are provided with program synchronized audio and control data to interact with the program viewer in relationship to the television program.

US Patent 5,195,920 to Collier describes a radio controlled toy vehicle which generates realistic sound effects on board the vehicle. Communications with a remote computer allows an operator to modify and add new sound effects.

US Patent 5,270,480 to Hikawa describes a toy acting in response to a MIDI signal, wherein an instrument-playing toy performs simulated instrument playing movements.

US Patent 5,289,273 to Lang describes a system for remotely controlling an animated character. The system uses radio signals to transfer audio, video and other control signals to the animated character to provide speech, hearing vision and movement in real-time.

US Patent 5,388,493 describes a system for a housing for a vertical dual keyboard MIDI wireless controller for accordionists. The system may be used with either a conventional MIDI cable connection or by a wireless MIDI transmission system.

German Patent DE 3009-040 to Neuhierl describes a device for adding the capability to transmit sound from a remote control to a controlled model vehicle. The sound is generated by means of a microphone or a tape recorder and transmitted to the controlled model vehicle by means of radio communications. The model vehicle is equipped with a speaker that emits the received sounds.

The disclosures of all publications mentioned in the specification and of the publications cited therein are hereby incorporated by reference.

SUMMARY OF THE INVENTION

The present invention seeks to provide improved household appliances with psychological added value such as entertainment value. Because of the considerable drudgery involved in the majority of household tasks, psychologically stimulating features in household appliances are extremely useful in providing a pleasant, supportive, entertaining and/or empathic experience to users of household appliances, rather than a neutral, negative or boring experience.

According to a preferred embodiment of the present invention, a first household appliance communicates with a second appliance which senses the communication and acts upon it. According to another preferred embodiment of the present invention, a household appliance is provided which is capable of holding a dialogue with a user of the appliance and acting upon verbal inputs provided by the user in the course of the dialog.

A particular advantage of a household appliance which is capable of holding and acting upon a dialog with a user is that homemakers, like drivers, are often in a situation in which senses other than hearing are occupied, and/or in a situation in which their hands are occupied or are dirty. Therefore, it may be useful for a user of an appliance to have a recipe read to her, and/or to have a complicated cooking operation coordinated for her in that the appliance alerts

the user of the appropriate time to perform various cooking operations. For example, the user of an oven might be alerted each time it is necessary to baste a chicken. Optionally, a computer system is provided which generates oral messages regarding each appliance or each function of each appliance or each particular task (for example cooking chicken) in a different voice, e.g. a simulation of voices of different celebrities, in order to aid the user in differentiating between oral messages pertaining to different appliances or tasks.

Household appliances include but are not limited to kitchen equipment such as refrigerators, cooking devices, mixing devices and food processing devices; entertainment equipment such as VCRs and televisions, housekeeping equipment such as washing machines, dryers and vacuum cleaners, gardening equipment such as power lawn mowers and electric tools such as electric drills.

There is thus provided, in accordance with a preferred embodiment of the present invention, a wireless computer controlled household appliance system including a computer system including a first wireless transmitter and a first wireless receiver and operative to transmit a first transmission via the first wireless transmitter, and at least one household appliance including a second wireless transmitter and a second wireless receiver, the household appliance receiving the first transmission via the second wireless receiver and operative to carry out at least one action based on the first transmission, the household appliance being operative to transmit a second transmission via the second wireless transmitter and wherein the computer system is operative to receive the second transmission via the first wireless receiver.

Also provided, in accordance with a preferred embodiment of the present invention, is household appliance apparatus including at least one functional unit operative to perform a household operation, and an appliance personifier operative to simulate a personification of the functional unit for a user of the functional unit.

Further provided, in accordance with another preferred embodiment of the present invention, is a household appliance including a functional unit operative to perform a household operation, and an entertainment generator operative to provide entertainment to a user of the functional unit.

Additionally provided, in accordance with still another preferred embodiment of the present invention, is speaking household appliance apparatus including a functional unit operative to perform a household operation, and a speech generator operative to generate speech specimens audible to a user of the functional unit.

Further in accordance with a preferred embodiment of the present invention, the speech generator is operative to generate speech specimens having entertainment value for the user of the functional unit.

Still further in accordance with a preferred embodiment of the present invention, the functional unit includes at least one sensor operative to sense at least one ambient condition relevant to the functionality of the functional unit and wherein the speech generator is operative responsive to the at least one sensor.

Further in accordance with a preferred embodiment of the present invention, the speaking household appliance apparatus also includes an inter-appliance communication unit operative to receive messages from at least one other household appliance and the speech generator is operative responsive to the messages.

Still further in accordance with a preferred embodiment of the present invention, the entertainment generator includes a random entertainment generator operative to provide entertainment selected at least partly randomly from an entertainment repertoire.

Further in accordance with a preferred embodiment of the present invention, the appliance personifier includes a celebrity simulator operative to generate outputs causing a

perception, on the part of the user of at least one functional units, that the at least one functional units behave similarly to a celebrity.

Still further in accordance with a preferred embodiment of the present invention, the functional unit includes a loudspeaker and the celebrity simulator includes a personified audio message provider operative to provide verbal messages in a voice resembling the voice of a celebrity, to the loudspeaker.

Also provided, in accordance with another preferred embodiment of the present invention, is a computerized household appliance system including a plurality of household chore performing appliances distributed in a corresponding plurality of rooms throughout a dwelling-place, each household chore performing appliance including a functional unit, and a loudspeaker for conveying audio messages to a user, and a computer operative to generate audio messages for a user, and to convey the audio messages to the user using at least one of the plurality of loudspeakers.

Further in accordance with a preferred embodiment of the present invention, each appliance also includes a sensor operative to sense presence of the user and wherein the computer is operative to monitor the user's location by receiving information from the plurality of sensors and to convey the audio messages to the user using only those ones of the plurality of loudspeakers which are proximate to the user's current location as defined by the information received from the plurality of sensors.

Still further in accordance with a preferred embodiment of the present invention, the sensor includes a microphone.

Further in accordance with a preferred embodiment of the present invention, the computer system includes a computer, a computer radio interface communicating commands to the at least one household appliance, and a sound board device having at least one audio channel

and transmitting commands from the computer to the computer radio interface over the at least one audio channel.

Further in accordance with a preferred embodiment of the present invention, the at least one audio channel also includes an audio channel from the computer radio interface to the sound board device over which digital information arriving from at least one appliance is transmitted to the computer.

Further in accordance with a preferred embodiment of the present invention, the functional unit includes a loudspeaker and the appliance personifier includes a personified audio message provider operative to provide personified audio messages to the loudspeaker.

Still further in accordance with a preferred embodiment of the present invention, the functional unit includes a food-related appliance and wherein the appliance personifier is operative to simulate a diet-facilitating personification of the food-related appliance.

Also provided, in accordance with another preferred embodiment of the present invention, is a wireless computer controlled household appliance system including a computer system including a wireless transmitter for transmitting a command to perform at least one appliance action, and at least one household appliance including a wireless receiver, the receiver receiving the command from the transmitter, the appliance being operative to carry out at least one action based on the command.

Further provided, in accordance with a further preferred embodiment of the present invention, is a wireless computer controlled household appliance system including a computer system including a wireless receiver, and at least one household appliance including a wireless transmitter, the household appliance being operative to transmit a transmission via the wireless transmitter to the wireless receiver, the computer system being operative to receive the

transmission via the wireless receiver and to perform at least one action based on the transmission.

Also provided, in accordance with another preferred embodiment of the present invention, is a method for wireless computer control of household appliances including transmitting a first transmission from a computer via a first wireless transmitter, receiving the first transmission at at least one household appliance and carrying out at least one action based on the first transmission, and transmitting a second transmission from the at least one household appliance to the computer.

Additionally provided, in accordance with yet another preferred embodiment of the present invention, is a household appliance personification method including providing a household appliance including a functional unit operative to perform a household operation, and using the household appliance to simulate a personification of the functional unit for a user of the functional unit.

Also provided, in accordance with another preferred embodiment of the present invention, is a household entertainment method including providing a household appliance including a functional unit operative to perform a household operation, and using the household appliance to provide entertainment to a user of the functional unit.

Additionally provided, in accordance with yet another preferred embodiment of the present invention, is a method for performing household operations including providing a household appliance including a functional unit operative to perform a household operation, and generating speech specimens audible to a user of the functional unit.

Further provided, in accordance with another preferred embodiment of the present invention, is a computerized household appliance running method including distributing a plurality of household chore performing appliances in a corresponding plurality of rooms throughout a

dwelling-place, each household chore performing appliance including a functional unit and a loudspeaker for conveying audio messages to a user, using a computer to generate audio messages for a user, and conveying the audio messages to the user using at least one of the plurality of loudspeakers.

Also provided, in accordance with another preferred embodiment of the present invention, is a wireless computer controlled household appliance communication method including transmitting a command to perform at least one appliance action from a computer system including a wireless transmitter to at least one household appliance including a wireless receiver, and using the appliance to carry out at least one action based on the command.

Also provided, in accordance with yet another preferred embodiment of the present invention, is a wireless computer controlled household appliance communication method including transmitting a message to a computer system including a wireless receiver from at least one household appliance including a wireless transmitter, and using the computer to perform at least one computer action based on the transmission.

There is also provided in accordance with a preferred embodiment of the present invention a wireless computer controlled toy system including a computer system operative to transmit a first transmission via a first wireless transmitter and at least one toy including a first wireless receiver, the toy receiving the first transmission via the first wireless receiver and operative to carry out at least one action based on the first transmission.

The computer system may include a computer game. The toy may include a plurality of toys, and the at least one action may include a plurality of actions.

The first transmission may include a digital signal. The first transmission includes an analog signal and the analog signal may include sound.

Additionally in accordance with a preferred embodiment of the present invention the computer system includes a computer having a MIDI port and wherein the computer may be operative to transmit the digital signal by way of the MIDI port.

Additionally in accordance with a preferred embodiment of the present invention the sound includes music, a pre-recorded sound and/or speech. The speech may include recorded speech and synthesized speech.

Further in accordance with a preferred embodiment of the present invention the at least one toy has a plurality of states including at least a sleep state and an awake state, and the first transmission includes a state transition command, and the at least one action includes transitioning between the sleep state and the awake state.

A sleep state may typically include a state in which the toy consumes a reduced amount of energy and/or in which the toy is largely inactive, while an awake state is typically a state of normal operation.

Still further in accordance with a preferred embodiment of the present invention the first transmission includes a control command chosen from a plurality of available control commands based, at least in part, on a result of operation of the computer game.

Additionally in accordance with a preferred embodiment of the present invention the computer system includes a plurality of computers.

Additionally in accordance with a preferred embodiment of the present invention the first transmission includes computer identification data and the second transmission includes computer identification data.

Additionally in accordance with a preferred embodiment of the present invention the at least one toy is operative to transmit a second transmission via a second wireless transmitter

and the computer system is operative to receive the second transmission via a second wireless receiver.

Moreover in accordance with a preferred embodiment of the present invention the system includes at least one input device and the second transmission includes a status of the at least one input device.

Additionally in accordance with a preferred embodiment of the invention the at least one toy includes at least a first toy and a second toy, and wherein the first toy is operative to transmit a toy-to-toy transmission to the second toy via the second wireless transmitter, and wherein the second toy is operative to carry out at least one action based on the toy-to-toy transmission.

Further in accordance with a preferred embodiment of the present invention operation of the computer system is controlled, at least in part, by the second transmission.

Moreover in accordance with a preferred embodiment of the present invention the computer system includes a computer game, and wherein operation of the game is controlled, at least in part, by the second transmission.

The second transmission may include a digital signal and/or an analog signal.

Still further in accordance with a preferred embodiment of the present invention the computer system has a plurality of states including at least a sleep state and an awake state, and the second transmission include a state transition command, and the computer is operative, upon receiving the second transmission, to transition between the sleep state and the awake state.

Still further in accordance with a preferred embodiment of the present invention at least one toy includes sound input apparatus, and the second transmission includes a sound signal which represents a sound input via the sound input apparatus.

Additionally in accordance with a preferred embodiment of the present invention the computer system is also operative to perform at least one of the following actions: manipulate the sound signal; and play the sound signal.

Additionally in accordance with a preferred embodiment of the present invention the sound includes speech, and the computer system is operative to perform a speech recognition operation on the speech.

Further in accordance with a preferred embodiment of the present invention the second transmission includes toy identification data, and the computer system is operative to identify the at least one toy based, at least in part, on the toy identification data.

Still further in accordance with a preferred embodiment of the present invention the first transmission includes toy identification data. The computer system may adapt a mode of operation thereof based, at least in part, on the toy identification data.

Still further in accordance with a preferred embodiment of the present invention the at least one action may include movement of the toy, movement of a part of the toy and/or an output of a sound. The sound may be transmitted using a MIDI protocol.

There is also provided in accordance with another preferred embodiment of the present invention a game system including a computer system operative to control a computer game and having a display operative to display at least one display object, and at least one toy in wireless communication with the computer system, the computer game including a plurality of game objects, and the plurality of game objects includes the at least one display object and the at least one toy.

Further in accordance with a preferred embodiment of the present invention the at least one toy is operative to transmit toy identification data to the computer system, and the

computer system is operative to adapt a mode of operation of the computer game based, at least in part, on the toy identification data.

The computer system may include a plurality of computers.

Additionally in accordance with a preferred embodiment of the present invention the first transmission includes computer identification data and the second transmission includes computer identification data.

There is also provided in accordance with a preferred embodiment of the present invention a data transmission apparatus including first wireless apparatus including musical instrument data interface (MIDI) apparatus operative to receive and transmit MIDI data between a first wireless and a first MIDI device and second wireless apparatus including MIDI apparatus operative to receive and transmit MIDI data between a second wireless and a second MIDI device, the first wireless apparatus is operative to transmit MIDI data including data received from the first MIDI device to the second wireless apparatus, and to transmit MIDI data including data received from the second wireless apparatus to the first MIDI device, and the second wireless apparatus is operative to transmit MIDI data including data received from the second MIDI device to the first wireless apparatus, and to transmit MIDI data including data received from the first wireless apparatus to the second MIDI device.

Further in accordance with a preferred embodiment of the present invention the second wireless apparatus includes a plurality of wirelesses each respectively associated with one of the plurality of MIDI devices, and each of the second plurality of wirelesses is operative to transmit MIDI data including data received from the associated MIDI device to the first wireless apparatus, and to transmit MIDI data including data received from the first wireless apparatus to the associated MIDI device.

The first MIDI device may include a computer, while the second MIDI device may include a toy.

Additionally in accordance with a preferred embodiment of the present invention the first wireless apparatus also includes analog interface apparatus operative to receive and transmit analog signals between the first wireless and a first analog device, and the second wireless apparatus also includes analog interface apparatus operative to receive and transmit analog signals between the second wireless and a second analog device, and the first wireless apparatus is also operative to transmit analog signals including signals received from the first analog device to the second wireless apparatus, and to transmit analog signal including signals received from the second wireless apparatus to the first analog device, and the second wireless apparatus is also operative to transmit analog signals including signals received from the second analog device to the first wireless apparatus, and to transmit analog signals including data received from the first wireless apparatus to the second analog device.

There is also provided in accordance with another preferred embodiment of the present invention a method for generating control instructions for a computer controlled toy system, the method includes selecting a toy, selecting at least one command from among a plurality of commands associated with the toy, and generating control instructions for the toy including the at least one command.

Further in accordance with a preferred embodiment of the present invention the step of selecting at least one command includes choosing a command, and specifying at least one control parameter associated with the chosen command.

Still further in accordance with a preferred embodiment of the present invention the at least one control parameter includes at least one condition depending on a result of a previous command.

Additionally in accordance with a preferred embodiment of the present invention at least one of the steps of selecting a toy and the step of selecting at least one command includes utilizing a graphical user interface.

Still further in accordance with a preferred embodiment of the present invention the previous command includes a previous command associated with a second toy.

Additionally in accordance with a preferred embodiment of the present invention the at least one control parameter includes an execution condition controlling execution of the command.

The execution condition may include a time at which to perform the command and/or a time at which to cease performing the command. The execution condition may also include a status of the toy.

Additionally in accordance with a preferred embodiment of the present invention the at least one control parameter includes a command modifier modifying execution of the command.

Still further in accordance with a preferred embodiment of the present invention the at least one control parameter includes a condition dependent on a future event.

Additionally in accordance with a preferred embodiment of the present invention the at least one command includes a command to cancel a previous command.

There is also provided for in accordance with a preferred embodiment of the present invention a signal transmission apparatus for use in conjunction with a computer, the apparatus including wireless transmission apparatus; and signal processing apparatus including at least one of the following analog/digital sound conversion apparatus operative to convert analog sound signals to digital sound signals, to convert digital sound signals to analog sound signals, and to transmit the signals between the computer and a sound device using the wireless

transmission apparatus; a peripheral control interface operative to transmit control signals between the computer and a peripheral device using the wireless transmission apparatus; and a MIDI interface operative to transmit MIDI signals between the computer and a MIDI device using the wireless transmission apparatus.

There is also provided in accordance with another preferred embodiment of the present invention a computer system including a computer, and a sound card operatively attached to the computer and having a MIDI connector and at least one analog connector, wherein the computer is operative to transmit digital signals by means of the MIDI connector and to transmit analog signals by means of the at least one analog connector.

Further in accordance with a preferred embodiment of the present invention the computer is also operative to receive digital signals by means of the MIDI connector and to receive analog signals by means of the at least one analog connector.

It is also noted that throughout the specification and claims the term "radio" includes all forms of "wireless" communication.

In the illustrated embodiments, the central computer is shown as being separate from the appliances. However, it is appreciated that, alternatively, a computer may reside within one or more of the appliances or may be integrally formed therewith.

Methods and apparatus useful in implementing computer-controlled devices operated via remote control are described in Applicant/assignee's PCT Application No. PCT/IL96/00157.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated from the following detailed description, taken in conjunction with the drawings in which:

Figs. 1 - 32C illustrate a toy system for use in conjunction with a computer system wherein:

Fig. 1A is a partly pictorial, partly block diagram illustration of a computer control system including a toy, constructed and operative in accordance with a preferred embodiment of the present invention;

Fig. 1B is a partly pictorial, partly block diagram illustration a preferred implementation of the toy 122 of Fig. 1A;

Fig. 1C is a partly pictorial, partly block diagram illustration of a computer control system including a toy, constructed and operative in accordance with an alternative preferred embodiment of the present invention;

Figs. 2A - 2C are simplified pictorial illustrations of a portion of the system of Fig. 1A in use;

Fig. 3 is a simplified block diagram of a preferred implementation of the computer radio interface 110 of Fig. 1A;

Fig. 4 is a more detailed block diagram of the computer radio interface 110 of Fig. 3;

Figs. 5A - 5D taken together comprise a schematic diagram of the apparatus of Fig. 4;

Fig. 5E is an schematic diagram of an alternative implementation of the apparatus of Fig. 5D;

Fig. 6 is a simplified block diagram of a preferred implementation of the toy control device 130 of Fig. 1A;

Figs. 7A - 7F, taken together with either Fig. 5D or Fig. 5E, comprise a schematic diagram of the apparatus of Fig. 6;

Fig. 8A is a simplified flowchart illustration of a preferred method for receiving radio signals, executing commands comprised therein, and sending radio signals, within the toy control device 130 of Fig. 1A;

Figs. 8B - 8T, taken together, comprise a simplified flowchart illustration of a preferred implementation of the method of Fig. 8A;

Fig. 9A is a simplified flowchart illustration of a preferred method for receiving MIDI signals, receiving radio signals, executing commands comprised therein, sending radio signals, and sending MIDI signals, within the computer radio interface 110 of Fig. 1A;

Figs. 9B - 9N, taken together with Figs. 8D - 8M, comprise a simplified flowchart illustration of a preferred implementation of the method of Fig. 9A;

Figs. 10A - 10C are simplified pictorial illustrations of a signal transmitted between the computer radio interface 110 and the toy control device 130 of Fig. 1A;

Fig. 11 is a simplified flowchart illustration of a preferred method for generating control instructions for the apparatus of Fig. 1A;

Figs. 12A - 12C are pictorial illustrations of a preferred implementation of a graphical user interface implementation of the method of Fig. 11;

Fig. 13 is a block diagram of a first sub-unit of a multi-port multi-channel implementation of the computer radio interface 110 of Fig. 1A, which sub-unit resides within computer 100 of Fig. 1A;

Fig. 14 is a block diagram of a second sub-unit of a multi-port multi-channel implementation of the computer radio interface 110 of Fig. 1A, which sub-unit complements the apparatus of Fig. 13 and resides exteriorly to computer 100 of Fig. 1A;

Figs. 15A - 15E, taken together, form a detailed electronic schematic diagram of 6, suitable for the multi-channel implementation of Figs. 13 and 14;

Fig. 16 is a simplified flowchart illustration of a preferred method by which a computer selects a control channel pair in anticipation of a toy becoming available and starts a game-defining communication over the control channel each time both a toy and a transceiver of the computer radio interface are available;

Fig. 17 is a simplified flowchart illustration of a preferred method for implementing the "select control channel pair" step of Fig. 16;

Fig. 18A is a simplified flowchart illustration of a preferred method for implementing the "select information communication channel pair" step of Fig. 16;

Fig. 18B is a simplified flowchart illustration of a preferred method for performing the "locate computer" step of Fig. 18A;

Fig. 19 is a simplified flowchart illustration of a preferred method of operation of the toy control device 130;

Fig. 20 is a simplified illustration of a remote game server in association with a wireless computer controlled toy system which may include a network computer;

Fig. 21 is a simplified flowchart illustration of the operation of the computer or of the network computer of Fig. 20, when operating in conjunction with the remote server;

Fig. 22 is a simplified flowchart illustration of the operation of the remote game server of Fig. 20;

Fig. 23 is a semi-pictorial semi-block diagram illustration of a wireless computer controlled toy system including a proximity detection subsystem operative to detect proximity between the toy and the computer;

Figs. 24A - 24E, taken together, form a detailed electronic schematic diagram of a multi-channel implementation of the computer radio interface 110 of Fig. 3 which is similar to the

detailed electronic schematic diagrams of Figs. 5A - 5D except for being multi-channel, therefore capable of supporting full duplex applications, rather than single-channel;

Figs. 25A - 25F, taken together, form a detailed schematic illustration of a computer radio interface which connects to a serial port of a computer rather than to the sound board of the computer;

Figs. 26A - 26D, taken together, form a detailed schematic illustration of a computer radio interface which connects to a parallel port of a computer rather than to the sound board of the computer.;

Figs. 27A - 27J are preferred flowchart illustrations of a preferred radio coding technique which is an alternative to the radio coding technique described above with reference to Figs. 8E, 8G - 8M and 10A - C;

Figs. 28A - 28K, taken together, form a detailed electronic schematic diagram of the multi-port multi-channel computer radio interface sub-unit of Fig. 13;

Figs. 29A - 29I, taken together, form a detailed electronic schematic diagram of the multi-port multi-channel computer radio interface sub-unit of Fig. 14;

Fig. 30 is a partly pictorial, partly block diagram illustration of a computer control system including a toy, constructed and operative in accordance with a further preferred embodiment of the present invention;

Fig. 31 is a block diagram is a simplified block diagram illustrating the combination of the computer radio interface and the toy control device as used in the embodiment of Fig. 30; and

Figs. 32A, 32B and 32C taken together form a simplified block diagram of the EPLD chip of Fig. 28H; and

Figs. 33 - 53 illustrates embodiments of the toy system of Figs. 1 - 32C wherein:

Fig. 33 is a pictorial illustration of personified household appliances associated with a central computer 2100 by means of two-way radio communication;

Fig. 34 is a pictorial illustration of a modification of the apparatus of Fig. 33 in which a first appliance is associated by means of a wire with the computer and other appliances communicate with the computer via the first appliance, communication between the first appliance and the other appliances being wireless;

Fig. 35 is a pictorial illustration of personified household appliances associated with a central computer by means of an existing electrical household wiring system;

Figs. 36A - 36C, taken together, form a simplified flowchart illustration of a preferred method by which the computer controls the transceiver/controller 2130 of the refrigerator 2122 of Fig. 33;

Fig. 37 is an example of a portion of a user interface by which the computer is set up by a user of an appliance, to provide the user of the appliance with infotainment or entertainment;

Figs. 38A - 38B, taken together, form a simplified flowchart illustration of a preferred method of operation by which the computer provides the user of a washing machine with infotainment or entertainment;

Fig. 39 is a simplified diagram of the interface between computer radio interface and a soundboard of the computer;

Fig. 40 is a simplified block diagram of a preferred implementation for the computer radio interface of Fig. 33;

Fig. 41 is a simplified flowchart illustration of a preferred communication method allowing one of the computer radio interface and the computer to receive commands over the

audio channel, rather than over the MIDI channel, from the other one of the computer radio interface and the computer;

Fig. 42 is a diagram of the analog and digital representation of the SYNC, SQ, zero-valued bit and the one-valued bit signals;

Figs. 43A - 43E, taken together, form a detailed electronic schematic diagram of a preferred implementation of the apparatus of Fig. 40;

Fig. 44 is an example of a dialogue between a personified microwave oven and a personified dishwasher culminating in a verbal message emitted by a television;

Fig. 45 is a simplified flowchart illustration of a method of operation for a central computer according to a first preferred implementation of an inter-appliance dialogue such as the dialog of Fig. 44;

Fig. 46 is a flowchart illustration of a method of operation for an appliance according to a second preferred implementation of the dialogue of Fig. 45;

Fig. 47 is a pictorial illustration of a central computer 2100 accumulating information from users, via microphone bearing appliances, regarding consumable supplies to be replenished;

Fig. 48 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the refrigerator's role in the interaction of Fig. 47;

Fig. 49 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the washing machine's role in the interaction of Fig. 47;

Fig. 50 is a pictorial illustration of a scenario in which a central computer is accumulating information regarding household chore monitoring and timing;

Fig. 51 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the washing machine's role in the interaction of Fig. 50;

Fig. 52 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the dryer's role in the interaction of Fig. 50; and

Fig. 53 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the microwave oven's role in the interaction of Fig. 50.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is now made to Fig. 1A which is a partly pictorial, partly block diagram illustration of a computer control system including a toy, constructed and operative in accordance with a preferred embodiment of the present invention. The system of Fig. 1A comprises a computer 100, which may be any suitable computer such as, for example, an IBM-compatible personal computer. The computer 100 is equipped with a screen 105. The computer 100 is preferably equipped with a sound card such as, for example, a Sound Blaster Pro card commercially available from Creative Labs, Inc., 1901 McCarthy Boulevard, Milpitas CA 95035 or from Creative Technology Ltd., 67 Ayer Rajah Crescent #03-18, Singapore, 0513; a hard disk; and, optionally, a CD-ROM drive.

The computer 100 is equipped with a computer radio interface 110 operative to transmit signals via wireless transmission based on commands received from the computer 100 and, in a preferred embodiment of the present invention, also to receive signals transmitted elsewhere via wireless transmission and to deliver the signals to the computer 100. Typically, commands transmitted from the computer 100 to the computer radio interface 110 are transmitted via both analog signals and digital signals, with the digital signals typically being transmitted by way of a MIDI port. Transmission of the analog and digital signals is described below with reference to Fig. 3.

The transmitted signal may be an analog signal or a digital signal. The received signal may also be an analog signal or a digital signal. Each signal typically comprises a message. A preferred implementation of the computer radio interface 110 is described below with reference to Fig. 3.

The system of Fig. 1A also comprises one or more toys 120. The system of Fig. 1A comprises a plurality of toys, namely three toys 122, 124, and 126 but it is appreciated that, alternatively, either one toy only or a large plurality of toys may be used.

Reference is now additionally made to Fig. 1B, which is a partly pictorial, partly block diagram illustration of the toy 122 of Fig. 1A.

Each toy 120 comprises a power source 125, such as a battery or a connection to line power. Each toy 120 also comprises a toy control device 130, operative to receive a wireless signal transmitted by the computer 100 and to cause each toy 120 to perform an action based on the received signal. The received signal may be, as explained above, an analog signal or a digital signal. A preferred implementation of the toy control device 130 is described below with reference to Fig. 6.

Each toy 120 preferably comprises a plurality of input devices 140 and output devices 150, as seen in Fig. 1B. The input devices 140 may comprise, for example on or more of the following: a microphone 141; a microswitch sensor 142; a touch sensor (not shown in Fig. 1B); a light sensor (not shown in Fig. 1B); a movement sensor 143, which may be, for example, a tilt sensor or an acceleration sensor. Appropriate commercially available input devices include the following: position sensors available from Hamlin Inc., 612 East Lake Street, Lake Mills, WI 53551, USA; motion and vibration sensors available from Comus International, 263 Hillside Avenue, Nutley, New Jersey 07110, USA; temperature, shock, and magnetic sensors available from Murata Electronics Ltd., Hampshire, England; and switches available from C & K

Components Inc., 15 Riverdale Avenue, Newton, MA 02058-1082, USA or from Micro Switch Inc., a division of Honeywell, USA. The output devices 150 may comprise, for example, one or more of the following: a speaker 151; a light 152; a solenoid 153 which may be operative to move a portion of the toy; a motor, such as a stepping motor, operative to move a portion of the toy or all of the toy (not shown in Fig. 1B). Appropriate commercially available output devices include the following: DC motors available from Alkatel (dunkermotoren), Postfach 1240, D-7823, Bonndorf/Schwarzald, Germany; stepping motors and miniature motors available from Haydon Switch and Instruments, Inc. (HSI), 1500 Meriden Road, Waterbury, CT, USA; and DC solenoids available from Communications Instruments, Inc., P.O. Box 520, Fairview, North Carolina 28730, USA.

Examples of actions which the toy may perform include the following: move a portion of the toy; move the entire toy; or produce a sound, which may comprise one or more of the following: a recorded sound, a synthesized sound, music including recorded music or synthesized music, speech including recorded speech or synthesized speech.

The received signal may comprise a condition governing the action as, for example, the duration of the action, or the number of repetitions of the action.

Typically, the portion of the received signal comprising a message comprising a command to perform a specific action as, for example, to produce a sound with a given duration, comprises a digital signal. The portion of the received signal comprising a sound, for example, typically comprises an analog signal. Alternatively, in a preferred embodiment of the present invention, the portion of the received signal comprising a sound, including music, may comprise a digital signal, typically a signal comprising MIDI data.

The action the toy may perform also includes reacting to signals transmitted by another toy, such as, for example, playing sound that the other toy is monitoring and transmitting.

In a preferred embodiment of the present invention, the toy control device 130 is also operative to transmit a signal intended for the computer 100, to be received by the computer radio interface 110. In this embodiment, the computer radio interface 110 is preferably also operative to poll the toy control device 130, that is, transmit a signal comprising a request that the toy control device 130 transmit a signal to the computer radio interface 110. It is appreciated that polling is particularly preferred in the case where there are a plurality of toys having a plurality of toy control devices 130.

The signal transmitted by the toy control device 130 may comprise one or more of the following: sound, typically sound captured by a microphone input device 141; status of sensor input devices 140 as, for example, light sensors or micro switch; an indication of low power in the power source 125; or information identifying the toy.

It is appreciated that a sound signal transmitted by the device 130 may also include speech. The computer system is operative to perform a speech recognition operation on the speech signals.

Appropriate commercially available software for speech recognition is available from companies such as: Stylus Innovation Inc., One Kendall Square, Building 300, Cambridge, MA 02139, USA; A&G Graphics Interface, USA, Telephone No. (617) 492-0120, Telefax No. (617) 427-3625; "Dragon Dictate For Windows", available from Dragon Systems Inc., 320 Nevada Street, MA. 02160, USA, and "SDK" available from Lernout & Hausple Speech Products, Sint-Krispijnstraat 7, 8900 Leper, Belgium.

The signal from the radio control interface 110 may also comprise, for example, one or more of the following: a request to ignore input from one or more input devices 140; a request to activate one or more input devices 140 or to stop ignoring input from one or more input devices 140; a request to report the status of one or more input devices 140; a request to

store data received from one or more input devices 140, typically by latching a transition in the state of one or more input devices 140, until a future time when another signal from the radio control interface 110 requests the toy control device 130 to transmit a signal comprising the stored data received from the one or more input devices 140; or a request to transmit analog data, typically comprising sound, typically for a specified period of time.

Typically, all signals transmitted in both directions between the computer radio interface 110 and the toy control device 130 include information identifying the toy.

Reference is now made to Fig. 1C, which is a partly pictorial, partly block diagram illustration of a computer control system including a toy, constructed and operative in accordance with an alternative preferred embodiment of the present invention. The system of Fig. 1C comprises two computers 100. It is appreciated that, in general, a plurality of computers 100 may be used. In the implementation of Fig. 1C, all signals transmitted in both directions between the computer radio interface 110 and the toy control device 130 typically include information identifying the computer.

The operation of the system of Fig. 1A is now briefly described. Typically, the computer 100 runs software comprising a computer game, typically a game including at least one animated character. Alternatively, the software may comprise educational software or any other interactive software including at least one animated object. As used herein, the term "animated object" includes any object which may be depicted on the computer screen 105 and which interacts with the user of the computer via input to and output from the computer. An animated object may be any object depicted on the screen such as, for example: a doll; an action figure; a toy, such as, for example, an activity toy, a vehicle, or a ride-on vehicle; a drawing board or sketch board; or a household object such as, for example, a clock, a lamp, a chamber pot, or an item of furniture.

Reference is now additionally made to Figs 2A - 2C, which depict a portion of the system of Fig. 1A in use. The apparatus of Fig. 2A comprises the computer screen 105 of Fig. 1A. On the computer screen are depicted animated objects 160 and 165.

Fig. 2B depicts the situation after the toy 122 has been brought into range of the computer radio interface 110 of Fig. 1A, typically into the same room therewith. Preferably, the toy 122 corresponds to the animated object 160. For example, in Fig. 2B the toy 122 and the animated object 160, shown in Fig. 2A, are both a teddy bear. The apparatus of Fig. 2B comprises the computer screen 105, on which is depicted the animated object 165. The apparatus of Fig. 2B also comprises the toy 122. The computer 100, having received a message via the computer radio interface 110, from the toy 122, no longer displays the animated object 160 corresponding to the toy 122. The functions of the animated object 160 are now performed through the toy 122, under control of the computer 100 through the computer radio interface 110 and the toy control device 130.

Fig. 2C depicts the situation after the toy 126 has also been brought into range of the computer radio interface 110 of Fig. 1A, typically into the same room therewith. Preferably, the toy 126 corresponds to the animated object 165. For example, in Fig. 2C the toy 126 and the animated object 165, shown in Figs. 2A and 2B, are both a clock. The apparatus of Fig. 2C comprises the computer screen 105, on which no animated objects are depicted.

The apparatus of Fig. 2C also comprises the toy 126. The computer 100, having received a message via the computer radio interface 110 from the toy 126, no longer displays the animated object 165 corresponding to the toy 126. The functions of the animated object 165 are now performed through the toy 126, under control of the computer 100 through the computer radio interface 110 and the toy control device 130.

In Fig. 2A, the user interacts with the animated objects 160 and 165 on the computer screen, typically using conventional methods. In Fig. 2B the user also interacts with the toy 122, and in Fig. 2C typically with the toys 122 and 126, instead of interacting with the animated objects 160 and 165 respectively. It is appreciated that the user may interact with the toys 122 and 126 by moving the toys or parts of the toys; by speaking to the toys; by responding to movement of the toys which movement occurs in response to a signal received from the computer 100; by responding to a sound produced by the toys, which sound is produced in response to a signal received from the computer 100 and which may comprise music, speech, or another sound; or otherwise.

Reference is now made to Fig. 3 which is a simplified block diagram of a preferred embodiment of the computer radio interface 110 of Fig. 1A. The apparatus of Fig. 3 comprises the computer radio interface 110. The apparatus of Fig. 3 also comprises a sound card 190, as described above with reference to Fig. 1A. In Fig. 3, the connections between the computer radio interface 110 and the sound card 190 are shown.

The computer radio interface 110 comprises a DC unit 200 which is fed with power through a MIDI interface 210 from a sound card MIDI interface 194, and the following interfaces: a MIDI interface 210 which connects to the sound card MIDI interface 194; an audio interface 220 which connects to an audio interface 192 of the sound card 190; and a secondary audio interface 230 which preferably connects to a stereo sound system for producing high quality sound under control of software running on the computer 100 (not shown).

The apparatus of Fig. 3 also comprises an antenna 240, which is operative to send and receive signals between the computer radio interface 110 and one or more toy control devices 130.

Fig. 4 is a more detailed block diagram of the computer radio interface 110 of Fig. 3. The apparatus of Fig. 4 comprises the DC unit 200, the MIDI interface 210, the audio interface 220, and the secondary audio interface 230. The apparatus of Fig. 4 also comprises a multiplexer 240, a micro controller 250, a radio transceiver 260, a connection unit 270 connecting the radio transceiver 260 to the micro controller 250, and a comparator 280.

Reference is now made to Figs. 5A - 5D, which taken together comprise a schematic diagram of the apparatus of Fig. 4.

The following is a preferred parts list for the apparatus of Figs. 5A - 5C:

1. K1 Relay Dept, Idec, 1213 Elco Drive, Sunnyvale, Calif. 94089-2211, USA.

2. U1 8751 microcontroller, Intel Corporation, San Tomas 4, 2700 San Tomas Expressway, 2nd Floor, Santa Clara 95051, CA USA.

3. U2 CXO - 12MHZ (crystal oscillator),Raltron, 2315 N.W. 107th Avenue, Miami Florida 33172, USA.

4. U4 MC33174, Motorola, Phoenix, AZ, USA., Tel. No. (602) 897-5056.

5. Diodes 1N914, Motorola, Phoenix, AZ, USA. Tel. No. (602)897-5056.

6. Transistors 2N2222 and MPSA14, Motorola, Phoenix, AZ, USA. Tel. No.(602)897-5056.

The following is a preferred parts list for the apparatus of Fig. 5D:

1. U1 SILRAX-418-A UHF radio telemetry receive module, Ginsburg Electronic GmbH, Am Moosfeld 85, D-81829, Munchen, Germany.

Alternatively, U1 of Fig. 5D may be replaced by:

U1 433.92MHz Receive Module Part No. 0927, available from CEL SALES LTD., Cel House, Unit 2, Block 6, Shenstone Trading Estate, Bromsgrove, Halesowen, West Midlands B36 3XB, UK.

2. U2 TXM-418-A low power UHF radio telemetry transmit module, Ginsburg Electronic GmbH, Am Moosfeld 85, D-1829, Munchen, Germany.

Alternatively, U2 of Fig. 5D may be replaced by:

U2 433.92 SIL FM Transmitter Module Part No, 5229, available from CEL SALES LTD., Cel House, Unit 2, Block 6, Shenstone Trading Estate, Bromsgrove, Halesowen, West Midlands B36 3XB UK.

Reference is now additionally made to Fig. 5E, which is a schematic diagram of an alternative implementation of the apparatus of Fig. 5D. The following is a preferred parts list for the apparatus of Fig. 5E:

1. U1 BIM-418-F low power UHF data transceiver module, Ginsburg Electronic GmbH, Am Moosfeld 85, D-81829, Munchen, Germany.

Alternate 1. U1 S20043 spread spectrum full duplex transceiver, AMI Semiconductors - American Microsystems, Inc., Idaho, USA.

Alternate 1. U1 SDT-300 synthesized transceiver, Circuit Design, Inc., Japan.

Alternatively, U1 may be replaced by:

U1 RY3GB021 RF 900Mhz units, available from SHARP ELECTRONIC COMPONENTS GROUP, 5700 Northwest, Pacific Rim Boulevard #20, Camas, Washington, USA.

U1 RY3GB100 RF Units For DECT, available from SHARP ELECTRONIC COMPONENTS GROUP 5700 Northwest, Pacific Rim Boulevard #20, Camas, Washington, USA.

In the parts list for Fig. 5E, one of item 1 or either of the alternate items 1 may be used for U1.

It is appreciated that the appropriate changes will have to be made to all the circuit boards for alternate embodiments of the apparatus.

The apparatus of Fig. 5E has similar functionality to the apparatus of Fig. 5D, but has higher bit rate transmission and reception capacity and is, for example, preferred when MIDI data is transmitted and received.

Figs. 5A - 5E are self-explanatory with regard to the above parts lists.

Reference is now made to Fig. 6 which is a simplified block diagram of a preferred embodiment of the toy control device 130 of Fig. 1A. The apparatus of Fig. 6 comprises a radio transceiver 260, similar to the radio transceiver 260 of Fig. 4. The apparatus of Fig. 6 also comprises a microcontroller 250 similar to the microcontroller 250 of Fig. 4.

The apparatus of Fig. 6 also comprises a digital input/output interface (digital I/O interface) 290, which is operative to provide an interface between the microcontroller 250 and a plurality of input and output devices which may be connected thereto such as, for example, four input device and four output devices. A preferred implementation of the digital I/O interface 290 is described in more detail below with reference to Fig. 7A - 7F.

The apparatus of Fig. 6 also comprises an analog input/output interface (analog I/O interface) 300 operatively connected to the radio transceiver 260, and operative to receive signals therefrom and to send signals thereto.

The apparatus of Fig. 6 also comprises a multiplexer 305 which is operative, in response to a signal from the microcontroller 250, to provide output to the analog I/O interface 300 only when analog signals are being transmitted by the radio transceiver 260, and to pass input from the analog I/O interface 300 only when such input is desired.

The apparatus of Fig. 6 also comprises input devices 140 and output devices 150. In Fig. 6, the input devices 140 comprise, by way of example, a tilt switch operatively connected

to the digital I/O interface 290, and a microphone operatively connected to the analog I/O interface 300. It is appreciated that a wide variety of input devices 140 may be used.

In Fig. 6, the output devices 150 comprise, by way of example, a DC motor operatively connected to the digital I/O interface 290, and a speaker operatively connected to the analog I/O interface 300. It is appreciated that a wide variety of output devices 150 may be used.

The apparatus of Fig. 6 also comprises a DC control 310, a preferred implementation of which is described in more detail below with reference to Figs. 7A - 7F.

The apparatus of Fig. 6 also comprises a comparator 280, similar to the comparator 280 of Fig. 4.

The apparatus of Fig. 6 also comprises a power source 125, shown in Fig. 6 by way of example as batteries, operative to provide electrical power to the apparatus of Fig. 6 via the DC control 310.

Reference is now made to Figs. 7A - 7F which, taken together with either Fig. 5D or 5E, comprise a schematic diagram of the toy control device of Fig. 6. If the schematics of Fig. 5E is employed to implement the computer radio interface of Fig. 4, using RY3GB021 as U1 of Fig. 5E, then the same schematics of Fig. 5E are preferably employed to implement the toy control device of Fig. 6 except that RY3GH021 is used to implement U1 rather than RY3GB021.

The following is a preferred parts list for the apparatus of Figs. 7A - 7F:

1. U1 8751 microcontroller, Intel Corporation, San Tomas 4, 2700 San Tomas Expressway, 2nd Floor, Santa Clara 95051, CA USA.

2. U2 LM78L05, National Semiconductor, 2900 Semiconductor Drive, Santa Clara, CA. 95052, USA.

3. U3 CXO - 12MHz (crystal oscillator), Raltron, 2315 N.W. 107th Avenue, Miami, FL. 33172, USA.

4. U4 MC33174, Motorola, Phoenix, AZ, USA. Tel. No. (602) 897-5056.

5. U5 MC34119, Motorola, Phoenix, AZ, USA. Tel. No. (602) 897-5056.

6. U6 4066, Motorola, Phoenix, AZ, USA. Tel. No. (602) 897-5056.

7. Diode 1N914, 1N4005, Motorola, Phoenix, AZ, USA. Tel. No. (602) 897-5056.

8. Transistor 2N2222, 2N3906, Motorola, Phoenix, AZ, USA. Tel. No. (602) 897-5056.

9. Transistors 2N2907 and MPSA14, Motorola, Phoenix, AZ, USA. Tel. No. (602) 897-5056.

Figs. 7A - 7F are self-explanatory with reference to the above parts list.

As stated above with reference to Fig. 1A, the signals transmitted between the computer radio interface 110 and the toy control device 130 may be either analog signals or digital signals. It the case of digital signals, the digital signals preferably comprise a plurality of predefined messages, known to both the computer 100 and to the toy control device 130.

Each message sent by the computer radio interface 110 to the toy control device 130 comprises an indication of the intended recipient of the message. Each message sent by the toy control device 130 to the computer radio interface 110 comprises an indication of the sender of the message.

In the embodiment of Fig. 1C described above, messages also comprise the following:

each message sent by the computer radio interface 110 to the toy control device 130 comprises an indication of the sender of the message; and

each message sent by the toy control device 130 to the computer radio interface 110 comprises an indication of the intended recipient of the message.

A preferred set of predefined messages is as follows:

COMMAND STRUCTURE

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits

COMMANDS LIST

From the Computer to the Toy control device.

A. OUTPUT COMMANDS

SET_IO_TO_DATA

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	00	01	00	IO	00	D	x	x	

Set Toy control device output pin to a digital level D.

P:	Computer address	00-03 H
A:	unit address -	00-FF H
IO:	i/o number -	00-03 H
D:	Data-	00-01 H

Example

1. 01 00 00 05 **00 01** 03 01 00 **00** set io 3 to "1"
2. 01 00 00 05 **00 01** 03 00 00 **00** set io 3 to "0"

CHANGE_IO_FOR_TIME

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	00	02	00	IO	00	D	T1	T2	

Change Toy control device output pin to D for a period of time and then return to previous state.

P:	Computer address	00-03 H
A:	unit address -	00-FF H
IO:	i/o number -	00-03 H
T1,T2:	time -	00-FF H
D:	Data-	00-01 H

example:

1. 01 00 00 05 00 02 03 05 00 00 set io 3 to "1" for 5 seconds

B. INPUT COMMANDS

SEND_STATUS_OF_SENSORS

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	01	00	x	x	x	x	x	x	

send the Toy control device status of all sensors.

P: Computer address 00-03 H
A: unit address - 00-FF H

example:

1. 01 00 00 05 01 00 00 00 00 00 send current status of sensors

SENSORS_SCAN_MODE_ON

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	**01**	**01**	x	x	x	x	x	x	

Start scanning the Toy control device sensors, and if one of them is closed (pressed to '0'), send back an ack.

P: Computer address 00-03 H
A: unit address - 00-FF H

example:

1. 01 00 00 05 **01 01** 00 00 00 **00** scan mode of sensors ON

SENSORS_SCAN_MODE_ON_ONCE

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	01	02	x	x	x	x	x	x	

Start scanning the Toy control device sensors, and if one of them is closed (pressed to '0'), send back an ack, then disable scanning the sensors.

P: Computer address 00-03 H
A: unit address - 00-FF H

1. 01 00 00 05 01 02 00 00 00 00 scan mode of sensors ON once

SENSORS_SCAN_MODE_OFF

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	01	03	x	x	x	x	x	x	

Stop scanning the Toy control device sensors.

P: Computer address 00-03 H

A: unit address - 00-FF H

example:

1. 01 00 00 05 **01 03** 00 00 00 **00** scan mode of sensors OFF

C. AUDIO OUT COMMANDS

START_AUDIO_PLAY

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	02	00	x	x	x	x	xx	xx	

Start playing an audio in a speaker of the Toy control device The Audio is sent to the Toy control device by the computer sound card and the Computer radio interface.

P: Computer address 00-03 H
A: unit address - 00-FF H

1. 01 00 00 05 **02 00** 00 00 00 **00** Start audio-play

STOP_AUDIO_PLAY

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	02	01	x	x	x	x	x	x	

Stop playing an audio in a speaker of the Toy control device.

P: Computer address 00-03 H
A: unit address - 00-FF H

1. 01 00 00 05 02 01 00 00 00 00 Stop audio-play

START_AUDIO_AND_IO_PLAY_FOR_TIME

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	02	04	T1	T2	T0	td	SC	IO	

Start playing an audio in a speaker of the Toy control device and set an io pin to '1'. After time T, stop audio and set IO to '0'. start this command after a delay td*100ms. if SC="1" then after the execution of this command, start the input command SCAN_SENSORS_ON_ONCE (if any sensor is pressed, even during the audio play, send a message to the computer).

P:	Computer address	00-03 H	
A:	unit address -	00-FF H	
IO:	i/o number -	0-3 H	(if IO>3 then don't set IO)
T0,T1,T2:	TIME	000-FFF H	(*100ms) (T0=MMSB, T1=MSB T0=LSB)
td:	delay time befor execute	0-F H	(*100ms)

1. 01 00 00 05 02 04 80 2A 03 00
   Start audio-play and IO # 3 for 6.4 second
   640=280H
   delay before execution = 10*100ms=1sec
2. 01 00 00 05 02 04 80 2A 13 00
   Start audio-play and IO # 3 for 6.4 second and
   set scan sensors on once mode.
   delay before execution = 10*100ms=1sec

D. AUDIO IN COMMANDS

TRANSMIT_MIC_FOR_TIME

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	03	00	T1	T2	x	x	x	x	

Requests the Toy control device to Transmit microphone audio from the Toy control device to the Computer radio interface and to the sound card of the computer for time T.

P:	Computer address	00-03 H	
A:	unit address -	00-FF H	
T1,T2:	TIME	00-FF H	(SEC)

example:

1. 01 00 00 05 03 00 0A 00 00 00 start mic mode for 10 seconds

E. GENERAL TOY COMMANDS

GOTO_SLEEP_MODE

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	01	x	x	x	x	x	x	

Requests the Toy control device to go into power save mode (sleep).

P: Computer address 00-03 H
A: unit address - 00-FF H

1. 01 00 00 05 04 01 00 00 00 00 switch the Toy control device into sleep mode.

GOTO_AWAKE_MODE

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	02	x	x	x	x	x	x	

Requests the Toy control device to go into an awake mode .

P: Computer address 00-03 H
A: unit address - 00-FF H

1. 01 00 00 05 04 02 00 00 00 00 switch the Toy control device into awake mode.

TOY_RESET

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	0F	x	x	x	x	x	x	

Requests the Toy control device to perform RESET

P: Computer address 00-03 H
A: unit address - 00-FF H

1. 01 00 00 05 04 0F 00 00 00 00 Toy reset

TOY_USE_NEW_RF_CHANNELS

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	0A	CH1	CH2	x	x	x	x	

Requests the Toy control device to switch to new RF transmit and receive channels.

P:	Computer address	00-03 H
A:	unit address -	00-FF H
CH1:	Transmit RF channel number	0-F H
CH2:	Receive RF Channel number	0-F H

1. 01 00 00 05 04 0A 12 00 00 00 Switch to new RX and TX RF channels

Note: This command is available only with enhanced radio modules (alternate U1 of Fig. 5E) or with the modules described if Fig 15A-15E and 24A-24E.

F. TELEMETRY

Information sent by the Toy control device, as an ACK to the command received from the Computer radio interface.

OK_ACK

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	0A	00	cmd1	cmd2	cmd3	cmd4	sen1	sen2	

Send back an ACK about the command that was received ok.

P:	Computer address	00-03 H
A:	unit address -	00-FF H
cmd 1,2:	Received command MSB ok ack.	00-FF H
cmd 3,4:	Received command LSB ok ack.	00-FF H
sen 1,2	Sensors 0-7 status	00-FF H

1. 01 60 00 05 0A 00 01 01 FF 00 — OK ack for 0101 command.(sensors scan mode on command) . status: all sensors are not pressed (FF). the computer_radio_interface number is 6.
2. 01 60 00 05 0A 00 01 01 FE 00 — OK ack for 0101 command.(sensors scan mode on command) . status: sensor # 8 is pressed (FE)

the computer_radio_interface number is 6.

G. REQUESTS

Requests sent by the Toy control device, after an event.

TOY_IS_AWAKE_REQ

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	0A	00	c1	c2	x	x	x	x	

Send a message to the Computer radio interface if the Toy control device goes from sleep mode to awake mode.

P:	Computer address	00-03 H
A:	unit address -	00-FF H
c1,c2:	status command	AB H

1. 01 60 00 05 0A 00 AB 00 FF 00 Toy is awake message.

H. CRI (Computer Radio Interface)- commands

Commands that are sent only to the Computer radio interface.

SWITCH_AUDIO_OUT_TO_RADIO_&_TRANSMIT

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	x	0C	00	x	x	x	x	x	x	

Requests the Computer radio interface to switch audio_out from the computer sound card to the radio wireless transceiver and transmit.

P: Computer address 00-03 H

SWITCH_AUDIO_OUT_TO_JACK_&_STOP_TRANSMIT

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	x	0C	01	x	x	x	x	x	x	

Requests the Computer radio interface to switch audio_out from the radio RF wireless transceiver to the speakers jack and to stop transmit.

P: Computer address 00-03 H

MUTE_RADIO

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	x	0C	02	x	x	x	x	x	x	

Mute the radio transmit.

P: Computer address 00-03 H

UN-MUTE_RADIO

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	00	00	00	x	**0C**	**03**	x	x	x	x	x	x	

UN-Mute the radio transmit.

CRI_RESET

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8	bits -	- 8	bits -	- 8	bits -	CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	x	**0C**	**0F**	x	x	x	x	x	x	

Perform software reset on the Computer radio interface unit.

P: Computer address 00-03 H

I. CRI - ACK

ACK sent only to the Computer by the Computer radio interface, only after CRI commands.

CRI_COMMAND_ACK

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	x	**0D**	**00**	cmd1	cmd2	cmd3	cmd4	x	x	

This is an ACK for a CRI command. this ACK is sent to the computer by the computer-radio-interface, after executing a command successfully.

P:	Computer address	00-03 H
cmd 1,2:	Received CRI command MSB ok ack.	00-FF H
cmd 3,4:	Received CRI command LSB ok ack.	00-FF H

1. 01 60 00 00 **0D** 00 0C 01 00 **00** — OK ack for 0C01 CRI command (SWITCH AUDIO OUT TO JACK)
   the computer_radio_interface number is 6.
2. 01 60 00 00 **0D** 00 0C 0F 00 **00** — OK ack for 0C0F CRI command (CRI reset)
   the computer_radio_interface number is 6.
   This ack is also sent on POWER UP RESET

Reference is now made to Fig. 8A, which is a simplified flowchart illustration of a preferred method for receiving radio signals, executing commands comprised therein, and sending radio signals, within the toy control device 130 of Fig. 1A. Typically, each message as described above comprises a command, which may include a command to process information also comprised in the message. The method of Fig. 8A preferably comprises the following steps:

A synchronization signal or preamble is detected (step 400). A header is detected (step 403).

A command contained in the signal is received (step 405).

The command contained in the signal is executed (step 410). Executing the command may be as described above with reference to Fig. 1A.

A signal comprising a command intended for the computer radio interface 110 is sent (step 420).

Reference is now made to Figs. 8B - 8T which, taken together, comprise a simplified flowchart illustration of a preferred implementation of the method of Fig. 8A. The method of Figs. 8B - 8T is self-explanatory.

Reference is now made to Fig. 9A, which is a simplified flowchart illustration of a preferred method for receiving MIDI signals, receiving radio signals, executing commands comprised therein, sending radio signals, and sending MIDI signals, within the computer radio interface 110 of Fig. 1A. Some of the steps of Fig. 9A are identical to steps of Fig. 8A, described above. Fig. 9A also preferably comprises the following steps:

A MIDI command is received from the computer 100 (step 430). The MIDI command may comprise a command intended to be transmitted to the toy control device 130, may comprise an audio in or audio out command, or may comprise a general command.

A MIDI command is sent to the computer 100 (step 440). The MIDI command may comprise a signal received from the toy control device 130, may comprise a response to a MIDI command previously received by the computer radio interface 110 from the computer 100, or may comprise a general command.

The command contained in the MIDI command or in the received signal is executed (step 450). Executing the command may comprise, in the case of a received signal, reporting the command to the computer 100, whereupon the computer 100 may typically carry out any appropriate action under program control as, for example, changing a screen display or taking any other appropriate action in response to the received command. In the case of a MIDI command received from the computer 100, executing the command may comprise transmitting the command to the toy control device 130. Executing a MIDI command may also comprise switching audio output of the computer control device 110 between the secondary audio interface 230 and the radio transceiver 260. Normally the secondary audio interface 230 is directly connected to the audio interface 220 preserving the connection between the computer sound board and the peripheral audio devices such as speakers, microphone and stereo system.

Reference is now made to Figs. 9B - 9N, and additionally reference is made back to Figs. 8D - 8M, all of which, taken together, comprise a simplified flowchart illustration of a preferred implementation of the method of Fig. 9A. The method of Figs. 9B - 9M, taken together with Figs. 8D - 8M, is self-explanatory.

Reference is now additionally made to Figs. 10A - 10C, which are simplified pictorial illustrations of a signal transmitted between the computer radio interface 110 and the toy control device 130 of Fig. 1A. Fig. 10A comprises a synchronization preamble. The duration T_SYNC of the synchronization preamble is preferably .500 millisecond, being preferably substantially equally divided into on and off components.

Fig. 10B comprises a signal representing a bit with value 0, while Fig. 10C comprises a signal representing a bit with value 1.

It is appreciated that Figs. 10B and 10C refer to the case where the apparatus of Fig. 5D is used. In the case of the apparatus of Fig. 5E, functionality corresponding to that depicted in Figs. 10B and 10C is provided within the apparatus of Fig. 5E.

Preferably, each bit is assigned a predetermined duration T, which is the same for every bit. A frequency modulated carrier is transmitted, using the method of frequency modulation keying as is well known in the art. An "off" signal (typically less than 0.7 Volts) presented at termination 5 of U2 in Fig. 5D causes a transmission at a frequency below the median channel frequency. An "on" signal (typically over 2.3 Volts) presented at pin 5 of U2 in Fig. 5D causes a transmission at a frequency above the median frequency. These signals are received by the corresponding receiver U1. Output signal from pin 6 of U1 is fed to the comparator 280 of Figs. 4 and 6 that is operative to determine whether the received signal is "off" or "on", respectively.

It is also possible to use the comparator that is contained within U1 by connecting pin 7 of U1 of Fig. 5D, through pin 6 of the connector J1 of Fig. 5D, pin 6 of connector J1 of Fig. 5A, through the jumper to pin 12 of U1 of Fig. 5A.

Preferably, receipt of an on signal or spike of duration less than 0.01 * T is ignored. Receipt of an on signal as shown in Fig. 10B, of duration between 0.01 * T and 0.40 * T is preferably taken to be a bit with value 0. Receipt of an on signal as shown in Fig. 10C, of duration greater than 0.40 * T is preferably taken to be a bit with value 1. Typically, T has a value of 1.0 millisecond.

Furthermore, after receipt of an on signal, the duration of the subsequent off signal is measured. The sum of the durations of the on signal and the off signal must be between 0.90 T

and 1.10 T for the bit to be considered valid. Otherwise, the bit is considered invalid and is ignored.

Reference is now made to Fig. 11, which is a simplified flowchart illustration of a method for generating control instructions for the apparatus of Fig. 1A. The method of Fig. 11 preferably includes the following steps:

A toy is selected (step 550). At least one command is selected, preferably from a plurality of commands associated with the selected toy (steps 560 - 580). Alternatively, a command may be entered by selecting, modifying, and creating a new binary command (step 585).

Typically, selecting a command in steps 560 - 580 may include choosing a command and specifying one or more control parameters associated with the command. A control parameter may include, for example, a condition depending on a result of a previous command, the previous command being associated either with the selected toy or with another toy. A control parameter may also include an execution condition governing execution of a command such as, for example: a condition stating that a specified output is to occur based on a status of the toy, that is, if and only if a specified input is received; a condition stating that the command is to be performed at a specified time; a condition stating that performance of the command is to cease at a specified time; a condition comprising a command modifier modifying execution of the command, such as, for example, to terminate execution of the command in a case where execution of the command continues over a period of time; a condition dependent on the occurrence of a future event; or another condition.

The command may comprise a command to cancel a previous command.

The output of the method of Fig. 11 typically comprises one or more control instructions implementing the specified command, generated in step 590. Typically, the one or more control instructions are comprised in a command file. Typically, the command file is called

from a driver program which typically determines which command is to be executed at a given point in time and then calls the command file associated with the given command.

Preferably, a user of the method of Fig. 11 performs steps 550 and 560 using a computer having a graphical user interface. Reference is now made to Figs. 12A - 12C, which are pictorial illustrations of a preferred embodiment of a graphical user interface implementation of the method of Fig. 11.

Fig. 12A comprises a toy selection area 600, comprising a plurality of toy selection icons 610, each depicting a toy. The user of the graphical user interface of Figs. 12A - 12C typically selects one of the toy selection icons 610, indicating that a command is to be specified for the selected toy.

Fig. 12A also typically comprises action buttons 620, typically comprising one or more of the following:

a button allowing the user, typically an expert user, to enter a direct binary command implementing an advanced or particularly complex command not otherwise available through the graphical user interface of Figs. 12A - 12C;

a button allowing the user to install a new toy, thus adding a new toy selection icon 610; and

a button allowing the user to exit the graphical user interface of Figs. 12A - 12C.

Fig. 12B depicts a command generator screen typically displayed after the user has selected one of the toy selection icons 610 of Fig. 12A. Fig. 12B comprises an animation area 630, preferably comprising a depiction of the selected toy selection icon 610, and a text area 635 comprising text describing the selected toy.

Fig. 12B also comprises a plurality of command category buttons 640, each of which allow the user to select a category of commands such as, for example: output commands; input commands; audio in commands; audio out commands; and general commands.

Fig. 12B also comprises a cancel button 645 to cancel command selection and return to the screen of Fig. 12A.

Fig. 12C comprises a command selection area 650, allowing the user to specify a specific command. A wide variety of commands may be specified, and the commands shown in Fig. 12C are shown by way of example only.

Fig. 12C also comprises a file name area 655, in which the user may specify the name of the file which is to receive the generated control instructions. Fig. 12C also comprises a cancel button 645, similar to the cancel button 645 of Fig. 12B. Fig. 12C also comprises a make button 660. When the user actuates the make button 660, the control instruction generator of Fig. 11 generates control instructions implementing the chosen command for the chosen toy, and writes the control instructions to the specified file.

Fig. 12C also comprises a parameter selection area 665, in which the user may specify a parameter associated with the chosen command.

The above-described embodiment of Fig. 1C includes a description of a preferred set of predefined messages including a category termed "General commands". Other General Commands are defined by the following description:

MULTIPORT COMMANDS

AVAILABILITY_INTERROGATION_COMMAND

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	05	00	00	00	00	x	x	

A computer transmits this command to verify that the radio channel is vacant. If another computer is already using this channel it will respond with the Availability Response Command. If no response is received within 250msec the channel is deemed vacant.

P: Computer address 00-03 H

A: unit address - 00-FF H

AVAILABILITY_RESPONSE_COMMAND

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	06	00	00	00	00	x	x	

A computer transmits this command in response to an Availability Interrogation Command to announce that the radio channel is in use.

P: Computer address 00-03 H

A: unit address - 00-FF H

TOY_AVAILABILITY_COMMAND

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	07	00	00	00	00	x	x	

A Toy transmits this command to declare its existence and receive in response a Channel Pair Selection Command designating the computer that will control it and the radio channels to use.

P: Computer address 00-03 H

A: unit address - 00-FF H

CHANNEL_PAIR_SELECTION_COMMAND

byte 0	byte 1		byte 2	byte 3	byte 4	byte 5	byte 6		byte 7		byte 8		byte 9
Head	PC add	Unit # A-sb	Unit # B-sb	Unit # C-sb	CMD msb	CMD lsb	- 8 bits -		- 8 bits -		- 8 bits -		CRC
							Dat1 msb	Dat1 lsb	Dat2 msb	Dat2 lsb	Dat3 msb	Dat3 lsb	
8 bit	2 bit	6 bit	8 bit	8 bit	8 bit	8 bit	4 bit	4 bit	4 bit	4 bit	4 bit	4 bit	8 bits
01	P	00	00	A	04	08	CH1	CH2	00	00	x	x	

A computer transmits this command in response to a Toy Availability Command to inform the toy the radio channels to be used.

P: Computer address 00-03 H

A: unit address - 00-FF H

CH1:	Toy transmit channel	0- F H
CH1:	Toy receive channel	0- F H

In Figs. 13 and 14 there are illustrated block diagrams of multiport multi-channel implementation of the computer radio interface 110 of Fig. 1A. Fig. 13 illustrates the processing sub-unit of the computer interface that is implemented as an add-in board installed inside a PC. Fig. 14 is the RF transceiver which is a device external to the computer and connects to the processing subunit by means of a cable. In the present application of the RF unit there are 4 transceivers each capable of utilizing two radio channels simultaneously.

Referring briefly to Fig. 3, it is appreciated that, optionally, both sound and control commands may be transmitted via the MIDI connector 210 rather than transmitting sound commands via the analog connector 220. It is additionally appreciated that the functions of the interfaces 210 and 220 between the computer radio interface 110 and the sound card 190 may, alternatively, be implemented as connections between the computer radio interface 110 to the serial and/or parallel ports of the computer 100, as shown in Figs. 25A - 25F.

If it is desired to provide full duplex communication, each transceiver 260 which forms part of the computer radio interface 110 of Fig. 1A preferably is operative to transmit on a first channel pair and to receive on a different, second channel pair. The transceiver 260 (Fig. 4) which forms part of the toy control device 130 of Fig. 1A preferably is operative to transmit on the second channel and to receive on the first channel.

Any suitable technology may be employed to define at least two channel pairs such as narrow band technology or spread spectrum technologies such as frequency hopping technology or direct sequence technology, as illustrated in Figs. 15A - 15E, showing a Multi-Channel Computer Radio Interface, and in Figs. 24A - 24E showing a Multi-Channel Toy Control Device.

Reference is now made to Fig. 16 which is a simplified flowchart illustration of a preferred method of operation of a computer radio interface (CRI) 110 operative to service an

individual computer 100 of Fig. 1A without interfering with other computers or being interfered with by the other computers, each of which is similarly serviced by a similar CRI. Typically, the method of Fig. 16 is implemented in software on the computer 100 of Fig. 1A.

The CRI includes a conventional radio transceiver (260 of Fig. 4) which may, for example, comprise an RY3 GB021 having 40 channels which are divided into 20 pairs of channels. Typically, 16 of the channel pairs are assigned to information communication and the remaining 4 channel pairs are designated as control channels.

In the method of Fig. 16, one of the 4 control channel pairs is selected by the radio interface (step 810) as described in detail below in Fig. 17. The selected control channel pair i is monitored by a first transceiver (step 820) to detect the appearance of a new toy which is signaled by arrival of a toy availability command from the new toy (step 816). When the new toy is detected, an information communication channel pair is selected (step 830) from among the 16 such channel pairs provided over which game program information will be transmitted to the new toy. A preferred method for implementing step 830 is illustrated in self-explanatory flowchart Fig. 18A. The "Locate Computer" command in Fig. 18A (step 1004) is illustrated in the flowchart of Fig. 18B.

The identity of the selected information communication channel pair, also termed herein a "channel pair selection command", is sent over the control channel pair to the new toy (step 840). A game program is then begun (step 850), using the selected information communication channel pair. The control channel pair is then free to receive and act upon a toy availability command received from another toy. Therefore, it is desirable to assign another transceiver to that control channel pair since the current transceiver is now being used to provide communication between the game and the toy.

To assign a further transceiver to the now un-monitored control channel, the transceiver which was formerly monitoring that control channel is marked as busy in a transceiver availability table (step 852). The transceiver availability table is then scanned until an available transceiver, i.e. a transceiver which is not marked as busy, is identified (step 854). This transceiver is then assigned to the control channel i (step 858).

Fig. 17 is a simplified flowchart illustration of a preferred method for implementing "select control channel pair" step 810 of Fig. 16. In Fig. 17, the four control channels are scanned. For each channel pair in which the noise level falls below a certain threshold (step 895), the computer sends an availability interrogation command (step 910) and waits for a predetermined time period, such as 250 ms, for a response (steps 930 and 940). If no other computer responds, i.e. sends back an "availability response command", then the channel pair is deemed vacant. If the channel pair is found to be occupied the next channel is scanned. If none of the four channel pairs are found to be vacant, a "no control channel available" message is returned.

Fig. 19 is a self-explanatory flowchart illustration of a preferred method of operation of the toy control device 130 which is useful in conjunction with the "multi-channel" embodiment of Figs. 16 - 18B. i = 1, ..., 4 is an index of the control channels of the system. The toy control device sends a "toy availability command" (step 1160) which is a message advertising the toy's availability, on each control channel i in turn (steps 1140, 1150, 1210), until a control channel is reached which is being monitored by a computer. This becomes apparent when the computer responds (step 1180) by transmitting a "channel pair selection command" which is a message designating the information channel pair over which the toy control device may communicate with the game running on the computer. At this point (step 1190), the toy control device may begin receiving and executing game commands which the computer transmits over the information channel pair designated in the control channel i.

According to a preferred embodiment of the present invention, a computer system is provided, in communication with a remote game server, as shown in Fig. 20. The remote game server 1250 is operative to serve to the computer 100 at least a portion of at least one toy-operating game, which operates one or more toys 1260. Optionally, an entire game may be downloaded from the remote game server 1250. However, alternatively, a new toy action script or new text files may be downloaded from the remote game server 1250 whereas the remaining components of a particular game may already be present in the memory of computer 100.

Downloading from the remote game server 1250 to the computer 100 may take place either off-line, before the game begins, or on-line, in the course of the game. Alternatively, a first portion of the game may be received off-line whereas an additional portion of the game is received on-line.

The communication between the remote game server 1250 and the computer 100 may be based on any suitable technology such as but not limited to ISDN; X.25; Frame-Relay; and Internet.

An advantage of the embodiment of Fig. 20 is that a very simple computerized device may be provided locally, i.e. adjacent to the toy, because all "intelligence" may be provided from a remote source. In particular, the computerized device may be less sophisticated than a personal computer, may lack a display monitor of its own, and may, for example, comprise a network computer 1270.

Fig. 21 is a simplified flowchart illustration of the operation of the computer 100 or of the network computer 1260 of Fig. 20, when operating in conjunction with the remote server 1250.

Fig. 22 is a simplified flowchart illustration of the operation of the remote game server 1250 of Fig. 20.

Fig. 23 is a semi-pictorial semi-block diagram illustration of a wireless computer controlled toy system including a toy 1500 having a toy control device 1504, a computer 1510 communicating with the toy control device 1504 by means of a computer-radio interface 1514 and a proximity detection subsystem operative to detect proximity between the toy and the computer. The proximity detection subsystem may for example include a pair of ultrasound transducers 1520 and 1530 associated with the toy and computer respectively. The toy's ultrasound transducer 1520 typically broadcasts ultrasonic signals which the computer's ultrasound transducer 1530 detects if the computer and toy are within ultrasonic communication range, e.g. are in the same room.

Figs. 24A - 24E, taken together, form a detailed electronic schematic diagram of a multi-channel implementation of the computer radio interface 110 of Fig. 3 which is similar to the detailed electronic schematic diagrams of Figs. 5A - 5D except for being multi-channel, therefore capable of supporting full duplex applications, rather than single-channel.

Figs. 25A - 25F, taken together, form a detailed schematic illustration of a computer radio interface which connects to a serial port of a computer rather than to the sound board of the computer.

Figs. 26A - 26D, taken together, form a detailed schematic illustration of a computer radio interface which connects to a parallel port of a computer rather than to the sound board of the computer.

Figs. 27A - 27J are preferred self-explanatory flowchart illustrations of a preferred radio coding technique, based on the Manchester coding, which is an alternative to the radio coding technique described above with reference to Figs. 8E, 8G - 8M and 10A - C.

Figs. 28A - 28K, taken together, form a detailed electronic schematic diagram of the multi-port multi-channel computer radio interface sub-unit of Fig. 13.

Figs. 29A - 29I, taken together, form a detailed electronic schematic diagram of the multi-port multi-channel computer radio interface sub-unit of Fig. 14.

Fig. 30 illustrates a further embodiment of the present invention which includes a combination of a Computer Radio Interface (CRI) and a Toy Control Device (TCD), 1610.

The combined unit 1610 controls a toy 1620 which is connected to the computer 100 by a device, such as a cable, and communicates with other toys, 120, by means such as radio communication, using the computer radio interface 110. The toy 1620 is operated in a similar manner as the toy device 120.

Fig 31 illustrates a simplified block diagram of the combined unit 1610.

Figs. 32A, 32B and 32C taken together form a simplified schematic diagram of the EP900 EPLD chip (U9) of Fig. 28H. The code to program the EPLD chip for this schematic diagram preferably uses the programming package "Max Plus II Ver. 6.2" available from Altera Corporation, 3525 Monroe Street, Santa Clara, CA. 5051, USA.

Figs. 33 - 53, described hereinbelow, illustrate various embodiments of the toy system of Figs. 1 - 32C.

Fig. 33 is a pictorial illustration of personified household appliances associated with a central computer 2100 by means of two-way wireless communication, typically via a computer radio interface 2110 associated with the computer and an appliance control device 2130, also termed herein transceiver/controller 2130, associated with a household appliance 2126. Suitable computer control provides a wide variety of personified household appliances such as but not limited to the following embodiments described in detail below: a refrigerator 2122 operating as a diet-mate, a microwave oven 2124 simulating a celebrity and a washing machine 2126 providing verbal or non-verbal humor or other entertainment. Each transceiver/controller 2130 is

preferably associated with a suitable combination of electro-mechanical accessories such as microphones 2142, speakers 2144, switches 2146 and solenoids 2148.

According to one embodiment of the present invention, the presence of a user in a particular room is sensed and audio messages to the user from any one of the appliances throughout the house are provided by an appliance in that room, via the computer 2100. Any suitable method may be used to sense the user's presence in a particular room such as voice recognition, volume detection, or bi-directional paging. The user may optionally attach a conventional personal locator, e.g. a IR badge, to his clothing or body such that his or her adjacency to a particular appliance may be sensed and the loudspeaker of that appliance may then be used to convey to the user information regarding that appliance or any other appliance in the household.

Alternatively, audio messages are broadcast to the user from all appliances in the house. It is appreciated that providing a loudspeaker in association with appliances is cost-effective relative to providing separate loudspeakers mounted in rooms and not in association with appliances. Each such loudspeaker would need to be associated via wire with the central computer 2100 or alternatively would need to be associated with a transceiver/controller.

Communication between appliances and central computer 2100 as well as, preferably, communication between the appliances themselves may be either wireless (Fig. 33) or custom-wired (Fig. 34) or by means of PLC (power line carrier) i.e. the household's existing electrical wiring system (Fig. 35), such as the PLC2.5-4.0/20W system, manufactured by Intracom SA, Greece and the PLC system ACE32, manufactured by Neva, Norway. Wireless communication may be implemented by means of any suitable technology such as radio wave technology or infra-red wave technology. Preferably the radio system of the present invention is based on the following: Spread Spectrum Transceivers, AIC9001 with IRF9085DS, available

from ALFA INCORPORATED, No. 15-1, Industry East Road.IV, Science-Based Industrial Park, Hsinchu, Taiwan, R.O.C.

Preferred implementations of computer radio interface 2110, some of which are operative in conjunction with an associated audio card (sound board) installed in computer 2100, are described hereinabove with reference to Figs. 1 - 32C. Preferred implementations of transceiver/controller 2130, are also described hereinabove with reference to Figs. 1 - 32C. It is appreciated that many modifications of the apparatus shown and described hereinabove with reference to Figs. 1 - 32C are possible. For example, in the embodiment of Figs. 6 and 7A-7F; and Figs 15A-15E, the motor 150 and the tilt switch 140 may be omitted.

It is appreciated that the game systems and toy system described herein can be implemented by using a home's appliances as games or causing the home appliances to function as toys. Preferably, the central computer is programmed to sense the presence of appliances and to adapt the game program so as to incorporate into the game a newly sensed appliance.

Fig. 34 is a pictorial illustration of a modification of the apparatus of Fig. 33 in which a first appliance 2126 is associated by means of a wire with the computer 2100 and other appliances 2122, 2124 communicate with the computer 2100 via the first appliance 2126, communication between the first appliance 2126 and the other appliances 2122, 2124 being wireless. Specifically, a first household appliance, such as a washing machine 2126, is associated by means of a wire with a computer 2100 and serves as a transceiver for transmitting commands and audio information to additional household appliances wirelessly associated with the first household appliance such as a refrigerator 2122 and a microwave oven 2124.

In Fig. 33, the computer radio interface 2110 provides celebrity simulation commands and audio information to the transceiver/controller 2130 of the microwave oven.

In Fig. 34, in contrast, the celebrity simulation commands and audio information are transmitted between appliances and a combined computer radio interface-transceiver/controller 2150 of the washing machine 2126. Combined unit 2150 is in turn associated by means of a wire 2152 with the computer 2100.

A preferred implementation for combined unit 2150 is described hereinabove with reference to Fig. 31.

The microwave oven 2124 may, for example, simulate a celebrity in the sense that voice messages pertaining to the microwave oven are given in the voice of a particular celebrity (Fig. 45). A particular advantage of giving voice messages pertaining to different appliances in the voices of different celebrities is that users of the appliances can learn to distinguish between messages "coming from" different appliances. This facilitates use of the appliances since an appliance delivering a voice message does not need to identify itself. Also, use of distinctive voices and mannerisms for different appliances enhances the perceived "personalities" of the various appliances. It is believed that granting a personality to an appliance can have a psychological effect on a user thereof, such as development of affection for the appliance, increased willingness to operate (interact with) the appliance and increased willingness to abide by suggestions provided by, or "decisions" made by the appliance, such as the diet-mate refrigerator described herein with reference to Figs. 36A - 36C.

According to a preferred embodiment of the present invention, an appliance simulating a particular celebrity is designed to resemble the celebrity. For example, a microwave oven simulating Pooh Bear might be green and have a Pooh Bear doll mounted thereupon.

Preferably, the voice messages or other characteristics of the microwave oven's behavior are designed to resemble the personality of the celebrity. It is appreciated that any and all of the appliances, including but not limited to the microwave oven, may simulate a celebrity.

As shown in Fig. 33, appliances also preferably provide status updates to the computer 2100 via the computer radio interface 2110 (Fig. 45). Optionally, the status update signals provided to the computer are augmented by oral status updates which are audible to users of the appliances.

Fig. 35 is a pictorial illustration of personified household appliances associated with a central computer 2100 by means of an existing electrical household wiring system 2128.

Figs. 36A - 36C, taken together, form a simplified flowchart illustration of a preferred method by which the computer controls the transceiver/controller 2130 of the refrigerator 2122 of Fig. 33. The method of Figs. 36A - 36C enables the refrigerator to function as a "diet-mate", in a first supportive mode or in a second, aggressive mode. The mode (supportive or aggressive) may be preset by the user either initially or in the course of using the appliance (step 2350 of Fig. 36B) or may be randomly selected by the computer or may be programmed by the user such that different modes are used at different times of day or under different circumstances. Alternatively, the mode may be set by the computer conditionally, depending on the behavior of the user. Typically, the supportive mode is active until the dieter has exceeded his daily calorie count at which point the aggressive mode becomes active. Optionally, different personalities or celebrities may be associated with the two modes.

Preferably, the computer performs a voice signature matching process to determine whether the user is an impostor, i.e. whether or not the user's name as supplied matches his voice. Conventional voice signature matching methods may be employed for this purpose (step 2326).

As shown, the refrigerator preferably includes a microswitch 2146 (Fig. 33) which detects opening of the refrigerator door (step 2318). The refrigerator's loudspeaker 2144 prompts the person opening the refrigerator to identify himself (step 2322). If the user does not identify

himself within a predetermined time period, the loudspeaker emits a message pleasantly urging or aggressively insisting that the user identify himself (steps 2322 to 2340).

The refrigerator's loudspeaker 2144 then asks the person to identify the food product or products he is removing from the refrigerator (step 2354).

The user's utterance is then recognized by a conventional speaker-dependent or speaker-independent speech recognition unit of the computer 2100 (steps 2358 to 2368).

If the user does not identify the food product/s within a predetermined time period, the loudspeaker emits a message pleasantly urging the user to do so or aggressively insisting that the user do so (step 2370).

Preferably, the calories corresponding to a typical portion of the food substance being removed are added to the sum total of calories consumed that day by the identified person (step 2380).

If the sum total of calories exceeds a predetermined daily total, which may for example be input in advance by the user, the loudspeaker preferably emits a randomly selected message politely requesting the user not to eat the foodstuffs in question or, in aggressive mode, blasting the user for eating the foodstuffs and demanding that s/he cease (step 2386). Alternatively or in addition, the above message may be provided if the food substance is in and of itself forbidden to the user, e.g. in accordance with a list of forbidden food items input in advance by the user.

In the illustrated embodiment, the apparatus does not prevent the dieter from opening the refrigerator. Alternatively, however, solenoid 2148 of Fig. 33 is employed to prevent the refrigerator from being opened if, for example, the dieter has exceeded his calorie quota for the day.

Fig. 37 is an example of a portion of a user interface by which the computer is set up by a user of an appliance, such as washing machine 2126 of Fig. 33, to provide the user of the appliance with infotainment or entertainment.

In the set up session, the user is preferably prompted to generate a "personal entertainment preference record". Specifically, the user is prompted to indicate his name, and to indicate any number of preference statements. Typically, each preference statement includes an activity, a time period and a sequence of preferences, such as only two preferences in the present embodiment.

According to one embodiment of the present invention, priorities are assigned by the system to the various preference statements. For example, preference statements stipulating a specific activity may take precedence over preference statements for "all" activities. Then, preference statements stipulating a narrow time period take precedence over preference statements stipulating a broad time period which includes the narrow time period.

Therefore, in the illustrated embodiment, preference statement 2410 has the highest priority for the laundry activity. Consequently, the user, when doing laundry, will be exposed to the weather report and, once it is over or if the user rejects the weather report, the system exposes the user to humor selections. If the user rejects the humor selections, then radio channel 2 is played to the user if the time is between 10:00 hours and 10:30 hours because the preference statement with the next highest priority is preference statement 2450. Otherwise, or if radio channel 2 was rejected by the user, chamber music is played to the user, assuming that it is morning, as stipulated by preference statement 2400. If the chamber music is rejected, the "next preference", i.e. classical music, is presented.

It is appreciated that many other formats may be used to elicit information from the user regarding his or her infotainment/entertainment preferences.

Figs. 38A - 38B, taken together, form a simplified flowchart illustration of a preferred method of operation by which the computer 2100 provides the user of a washing machine with infotainment or entertainment.

Reference is now made to Fig. 38A which illustrates the process of identifying the homemaker. After the user voice recognition procedure has been successfully completed, steps 2460 to 2510, the system then proceeds to present to the user the personal entertainment using his or hers personal preference record as illustrated in Fig. 38B.

Typically, once the system has selected the preference statement appropriate to a particular situation, the system presents the user with his top preference (step 2515) and stands by to receive a rejection message from the user, typically orally. If a rejection message is received, the system presents the user with his next preference. Once the user's last preference has been exhausted within the current preference statement, the system preferably advances to the next lower priority preference statement, according to a priority scheme between preference statements which may be either system-defined or user-defined (steps 2520 to 2522).

Preferably, the computer is operative to terminate provision of entertainment by the washing machine if the computer is informed that another appliance has detected the presence of the homemaker, indicating that the homemaker has left the vicinity of the washing machine.

Fig. 39 is a simplified diagram of the interface between computer radio interface 2110 and a soundboard 2600 of the computer 2110. The apparatus of Fig. 39 is a modification of the apparatus of Fig. 3 except that the MIDI connectors are omitted, such that the apparatus of Fig. 39 is useful in conjunction with sound-boards or computers which lack MIDI connectors.

Fig. 40 is a simplified block diagram of computer radio interface 2110. Fig. 40 is a modification of the apparatus of Fig. 4 except that the MIDI connectors are omitted, such that the

apparatus of Fig. 40 is useful in conjunction with sound-boards or computers which lack MIDI connectors.

Fig. 41 is a simplified flowchart illustration of a preferred communication method allowing one of the computer radio interface 2110 and the computer 2100 to receive commands over the audio channel, rather than over the MIDI channel, from the other one of the computer radio interface 2110 and the computer 2100. The method of Fig. 41 first detects whether an audio signal is currently arriving (step 2660) and if so, detects whether the audio signal comprises audio information (i.e. comprises the contents of an utterance which one of the appliances' speakers is supposed to emit) or a command. This is preferably effected by detecting whether or not a command-characterizing preamble has been received (step 2670). The command-characterizing preamble typically comprises SYNC followed by SQ signals as described in detail below with reference to Fig. 42.

Fig. 42 is a diagram of analog and digital representations 2700 and 2710 respectively of the following signals: SYNC, SQ, zero-valued bit and one-valued bit.

The frequencies and time durations of each of the above signals are as follows:

SIGNAL	FREQUENCY	TIME DURATION
SYNC	2 KHz	0.5 msec
SQ	500 Hz	2 msec
zero	1 Hz	1 msec
one	666 Hz	1.5 msec

Preferably, more than one audio channel connects the sound board 2600 and the computer radio interface 2110, and typically a first audio channel transmits audio signals from the

sound board 2600 to the computer radio interface and a second audio channel transmits audio signals in the opposite direction.

Figs. 43A - 43E, taken together, form a detailed electronic schematic diagram of a preferred implementation of the apparatus of Fig. 40.

Fig. 44 is an example of a dialogue between a personified microwave oven and a personified dishwasher culminating in a verbal message emitted by a television. The dialog is managed by the computer 2100. Preferably, the tone of voice of the personified microwave oven and of the personified dishwasher differ to allow listeners to differentiate therebetween. For example, the microwave oven's voice may simulate Paul Newman's voice and the dishwasher's voice may simulate Vivian Leigh's voice.

According to one embodiment of the present invention, simulations of a celebrity's voice may be provided by pre-recording sentences, phrases or words produced by a human model mimicking the celebrity or by the celebrity herself. Alternatively, commercially available text-to-speech systems exist which convert text to oral speech having a variety of characteristics such that the voices of different appliances can be made distinguishable.

Fig. 45 is a simplified flowchart illustration of a method of operation for a central computer according to a first preferred implementation of an inter-appliance dialogue such as the dialog of Fig. 44. In the embodiment of Fig. 45, a central computer controls all appliances and simulates, for the amusement of a user, a dialogue therebetween.

Preferably, the computer maintains a state machine representing the possible states that the household appliances may be in and/or a plurality of separate state machines representing the possible states that each of a plurality of household appliances respectively may be in. Each state defines at least one condition, each condition comprising a logical combination of events

triggering a connection to another state and/or an action to be performed by one or other of the appliances.

The events may include at least one of the following types of events: Counter events, timer events, events in which an input such as speech is received from a user, events in which a change in the environment is detected, events defined in terms of computations carried out by the computer, etc.

Fig. 46 is a flowchart illustration of a method of operation for an appliance according to a second preferred implementation of the dialogue of Fig. 45 in which each appliance is intelligent and preferably has speech recognition capabilities. Therefore, the dialogue is a real dialogue rather than a simulation of a dialogue which is in fact generated by the central computer.

Fig. 47 is a pictorial illustration of a central computer 2100 accumulating information from users, via microphone bearing appliances, regarding consumable supplies to be replenished. Preferably, the central computer 2100 also accumulates messages from the appliances themselves, e.g. indications of the number of times they have operated, which impacts on the supply of consumables for that appliance. The central computer then generates a shopping list, and communicates the shopping list, e.g. via modem 2111, to a shopping facility. In the illustrated embodiment, the central computer receives an indication of each operation of the washing machine and accumulates these indications. After a predetermined number of operations, the computer may add laundry powder to the list.

Typically, the computer automatically generates a shopping list, sends it to the store e.g. electronically, and zeroes all consumable supply counters. Preferably, oral messages regarding a particular task such as shopping are provided in the tone of voice of a celebrity.

Fig. 48 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the refrigerator's role in the interaction of Fig. 47.

Fig. 49 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the washing machine's role in the interaction of Fig. 47.

Fig. 50 is a pictorial illustration of a scenario in which a central computer is accumulating information regarding household chore monitoring and timing. This information may be provided by users, via sensor- bearing appliances, and/or by the appliances themselves. For example, in the illustrated scenario, the washing machine and dryer notify the homemaker, via the central computer, via the amplifier of the microwave oven, that washing and drying operations have both terminated. This facilitates coordination of household tasks since the home-maker is not only alerted to go downstairs and deal with the laundry but is alerted only once allowing him or her to go downstairs only once and deal with both the washer and the dryer.

In the illustrated embodiment, the messages to the home-maker are coordinated such that, for example, the alert that two laundry tasks can now be performed (communication F) is not provided in the midst of a food preparation task (microwave oven operation), even though the information is available to the computer. Instead, the alert regarding the two laundry tasks is delayed by the computer until such time that the food preparation task has terminated, i.e. until after communication D, which indicates that the home-maker has completed a food preparation task and is leaving the microwave oven.

Fig. 51 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the washing machine's role in the interaction of Fig. 50.

Fig. 52 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the dryer's role in the interaction of Fig. 50.

Fig. 53 is a script for the flowchart of Fig. 45 by which the computer 2100 implements the microwave oven's role in the interaction of Fig. 50.

The following variations of the illustrated embodiments may easily be provided:

a. Each appliance may have substantial computing power and therefore have independent intelligence, rather than being a "slave" to a central computer providing intelligence to a plurality of household appliances.

b. Intelligence may be provided to "slave" appliances by a "master" appliance associated with each of the "slave" appliances either wirelessly or by means of wire.

It is appreciated that different appliances are illustrated and described in the present invention as implementing different embodiments of the present invention. It is appreciated that generally, any embodiment of the invention may be implemented in any appliance and that the particular embodiment-appliance relationships shown and described herein are not intended to be limiting.

It is appreciated that the software components of the present invention may, if desired, be implemented in ROM (read-only memory) form. The software components may, generally, be implemented in hardware, if desired, using conventional techniques.

It is appreciated that various features of the invention which are, for clarity, described in the contexts of separate embodiments may also be provided in combination in a single embodiment. Conversely, various features of the invention which are, for brevity, described in the context of a single embodiment may also be provided separately or in any suitable subcombination.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather, the scope of the present invention is defined only by the claims which are:

CLAIMS

We claim:

1. A wireless computer controlled household appliance system comprising:

a computer system including a first wireless transmitter and a first wireless receiver and operative to transmit a first transmission via the first wireless transmitter; and

at least one household appliance including a second wireless transmitter and a second wireless receiver, said household appliance receiving said first transmission via said second wireless receiver and operative to carry out at least one action based on said first transmission, said household appliance being operative to transmit a second transmission via the second wireless transmitter and wherein the computer system is operative to receive the second transmission via said first wireless receiver.

2. Household appliance apparatus comprising:

at least one functional unit operative to perform a household operation; and

an appliance personifier operative to simulate a personification of the functional unit for a user of the functional unit.

3. A household appliance comprising:

a functional unit operative to perform a household operation; and

an entertainment generator operative to provide entertainment to a user of the functional unit.

4. Speaking household appliance apparatus comprising:

a functional unit operative to perform a household operation; and

a speech generator operative to generate speech specimens audible to a user of the functional unit.

5. Apparatus according to claim 4 wherein the speech generator is operative to generate speech specimens having entertainment value for the user of the functional unit.

6. Apparatus according to claim 4 wherein the functional unit comprises at least one sensor operative to sense at least one ambient condition relevant to the functionality of the functional unit and wherein the speech generator is operative responsive to said at least one sensor.

7. Apparatus according to claim 4 and also comprising an inter-appliance communication unit operative to receive messages from at least one other household appliance and wherein said speech generator is operative responsive to said messages.

8. Apparatus according to claim 5 wherein said entertainment generator comprises a random entertainment generator operative to provide entertainment selected at least partly randomly from an entertainment repertoire.

9. Apparatus according to claim 2 wherein said appliance personifier comprises a celebrity simulator operative to generate outputs causing a perception, on the part of the user of at least one functional units, that said at least one functional units behave similarly to a celebrity.

10. Apparatus according to claim 9 wherein said functional unit comprises a loudspeaker and said celebrity simulator comprises a personified audio message provider operative to provide verbal messages in a voice resembling the voice of a celebrity, to said loudspeaker.

11. A computerized household appliance system comprising:

a plurality of household chore performing appliances distributed in a corresponding plurality of rooms throughout a dwelling-place, each household chore performing appliance comprising:

a functional unit; and

a loudspeaker for conveying audio messages to a user; and

a computer operative to generate audio messages for a user, and to convey said audio messages to the user using at least one of said plurality of loudspeakers.

12. A system according to claim 11 wherein each said appliance also comprises a sensor operative to sense presence of the user and wherein said computer is operative to monitor said user's location by receiving information from said plurality of sensors and to convey said audio messages to the user using only those ones of said plurality of loudspeakers which are proximate to the user's current location as defined by said information received from said plurality of sensors.

13. A system according to claim 11 wherein said sensor comprises a microphone.

14. A system according to claim 1 wherein said computer system comprises:

a computer;

a computer radio interface communicating commands to the at least one household appliance; and

a sound board device having at least one audio channel and transmitting commands from the computer to the computer radio interface over the at least one audio channel.

15. A system according to claim 14 wherein said at least one audio channel also comprises an audio channel from the computer radio interface to the sound board device over which digital information arriving from at least one appliance is transmitted to the computer.

16. Apparatus according to claim 2 wherein said functional unit comprises a loudspeaker and said appliance personifier comprises a personified audio message provider operative to provide personified audio messages to said loudspeaker.

17. Apparatus according to claim 2 wherein said functional unit comprises a food-related appliance and wherein said appliance personifier is operative to simulate a diet-facilitating personification of the food-related appliance.

18. A wireless computer controlled household appliance system comprising:

a computer system including a wireless transmitter for transmitting a command to perform at least one appliance action; and

at least one household appliance including a wireless receiver, said receiver receiving said command from said transmitter, said appliance being operative to carry out at least one action based on said command.

19. A wireless computer controlled household appliance system comprising:

a computer system including a wireless receiver; and

at least one household appliance including a wireless transmitter, said household appliance being operative to transmit a transmission via the wireless transmitter to the wireless receiver, the computer system being operative to receive the transmission via said wireless receiver and to perform at least one action based on said transmission.

20. A method for wireless computer control of household appliances comprising:

transmitting a first transmission from a computer via a first wireless transmitter;

receiving said first transmission at at least one household appliance and carrying out at least one action based on said first transmission; and

transmitting a second transmission from said at least one household appliance to the computer.

21. A household appliance personification method comprising:

providing a household appliance including a functional unit operative to perform a household operation; and

using the household appliance to simulate a personification of the functional unit for a user of the functional unit.

22. A household entertainment method comprising:

providing a household appliance including a functional unit operative to perform a household operation; and

using the household appliance to provide entertainment to a user of the functional unit.

23. A method for performing household operations comprising:

providing a household appliance including a functional unit operative to perform a household operation; and

generating speech specimens audible to a user of the functional unit.

24. A computerized household appliance running method comprising:

distributing a plurality of household chore performing appliances in a corresponding plurality of rooms throughout a dwelling-place, each household chore performing appliance comprising a functional unit and a loudspeaker for conveying audio messages to a user;

using a computer to generate audio messages for a user; and

conveying said audio messages to the user using at least one of said plurality of loudspeakers.

25. A wireless computer controlled household appliance communication method comprising:

transmitting a command to perform at least one appliance action from a computer system including a wireless transmitter to at least one household appliance including a wireless receiver; and

using said appliance to carry out at least one action based on said command.

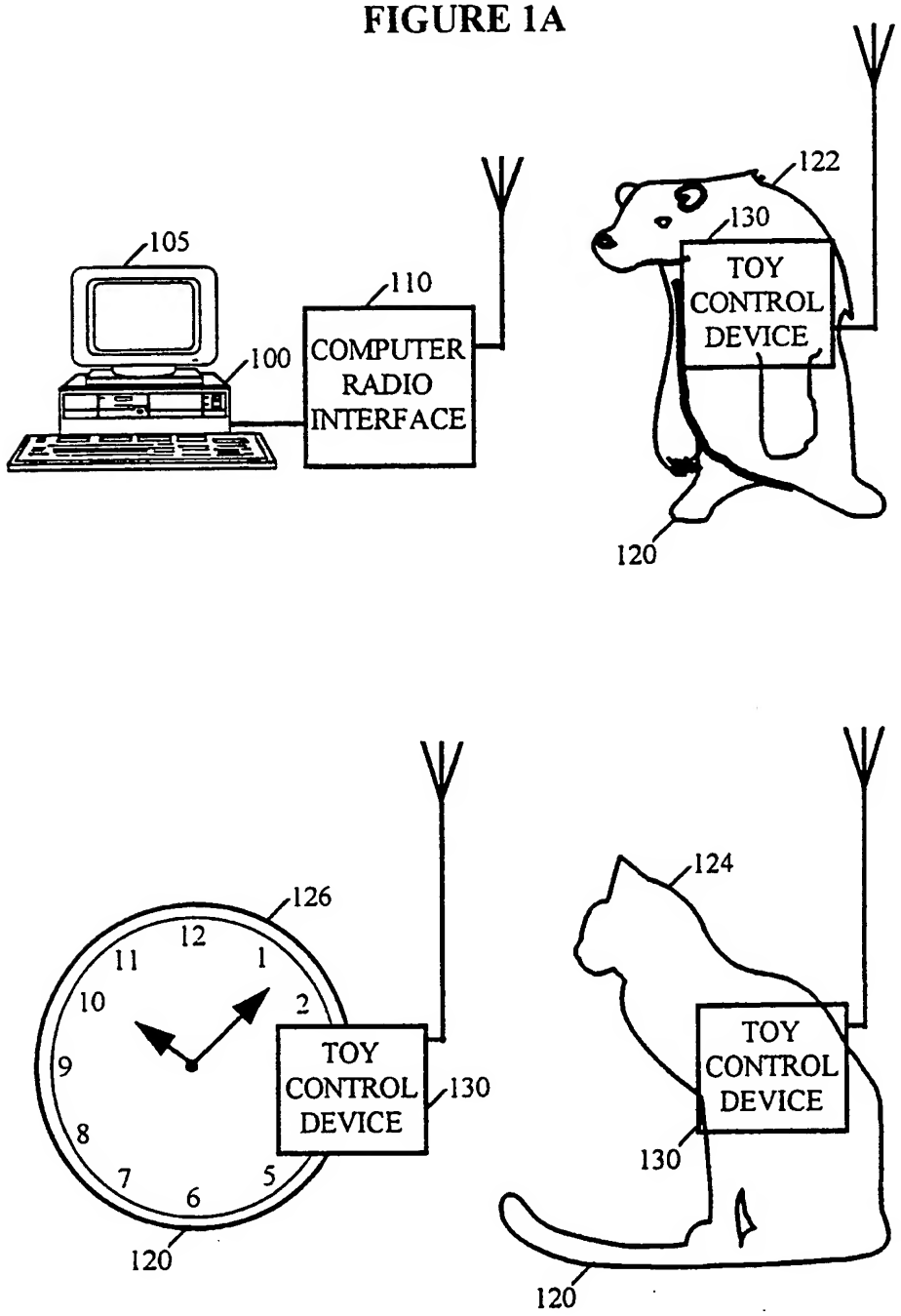
26. A wireless computer controlled household appliance communication method comprising:

transmitting a message to a computer system including a wireless receiver from at least one household appliance including a wireless transmitter; and

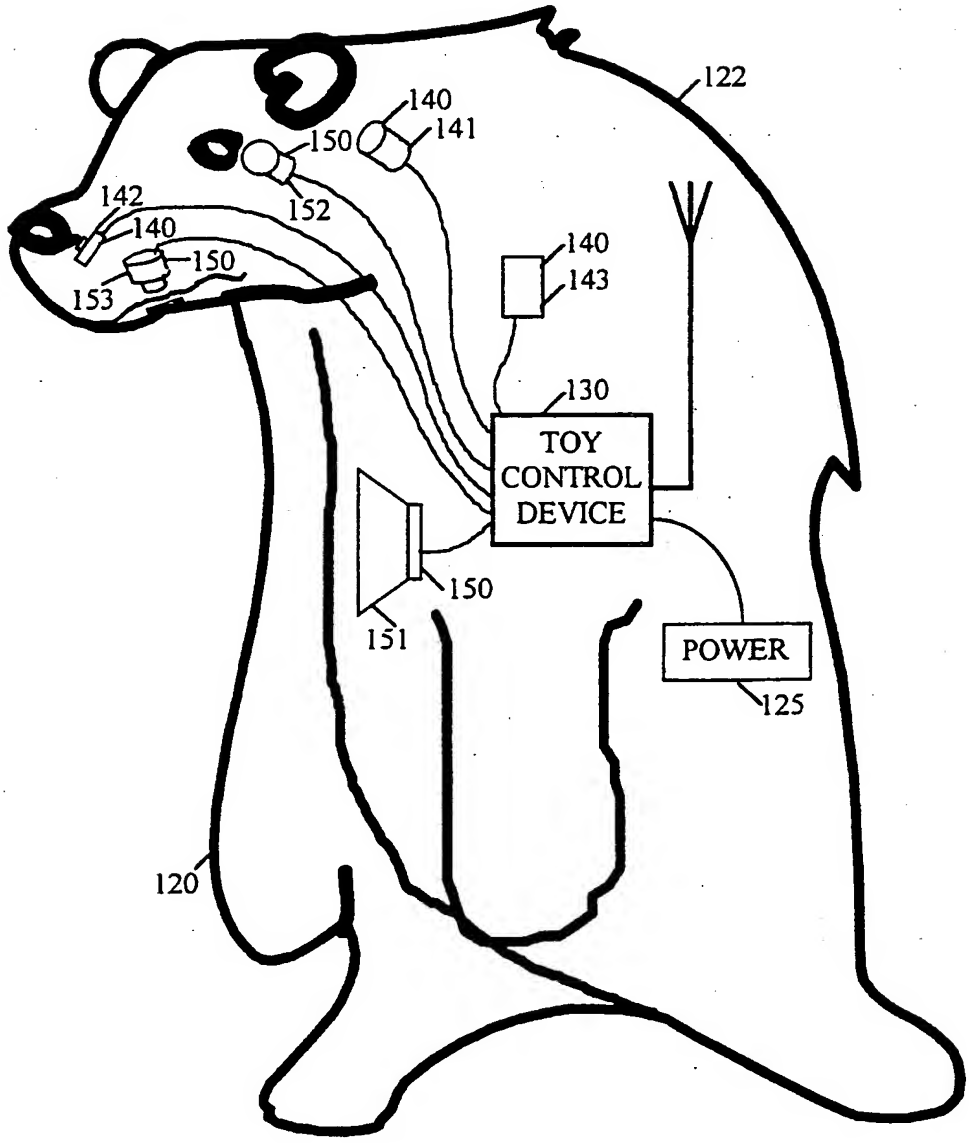
using said computer to perform at least one computer action based on said transmission.

1 /150

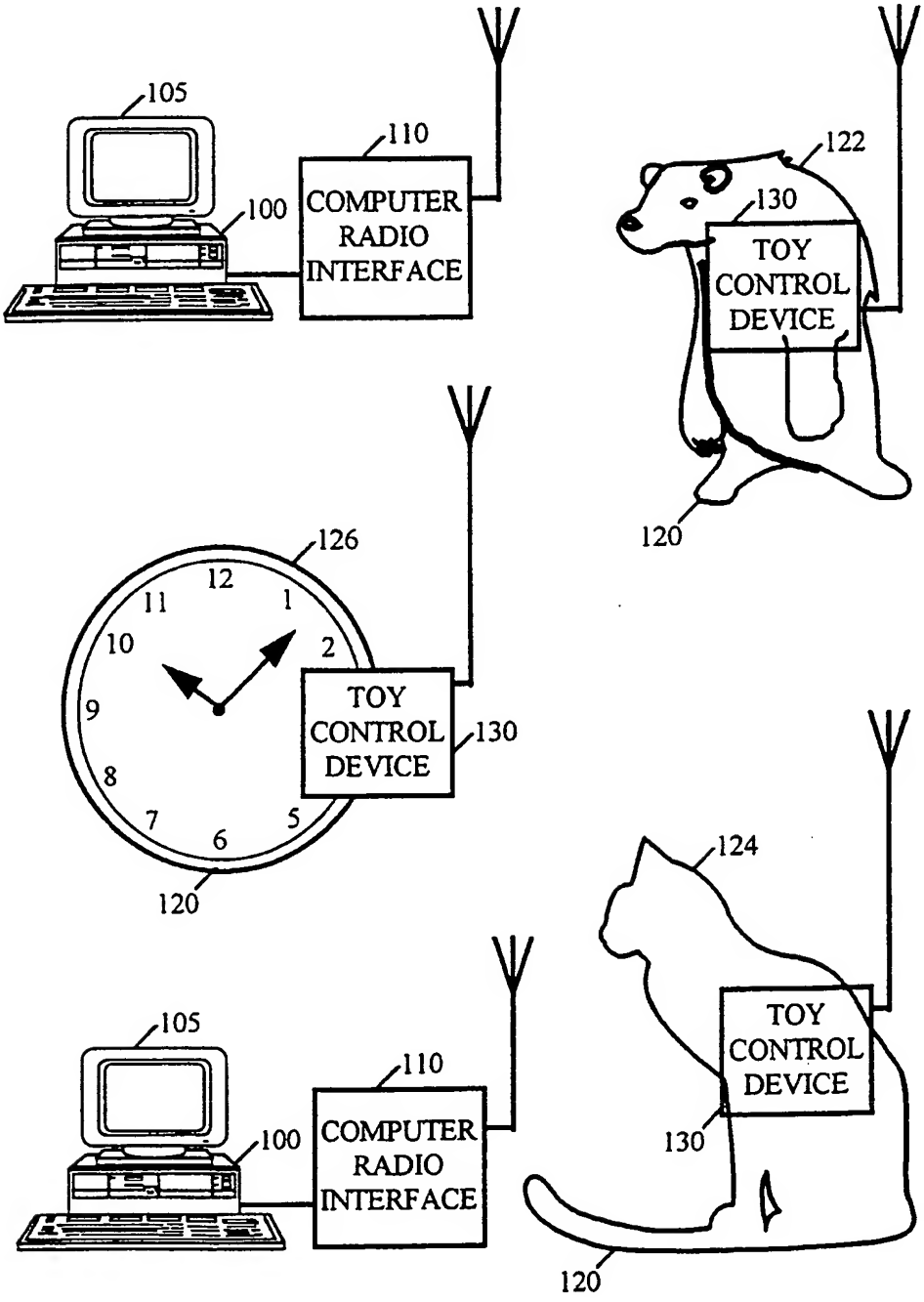
FIGURE 1A



2 /150
FIGURE 1B

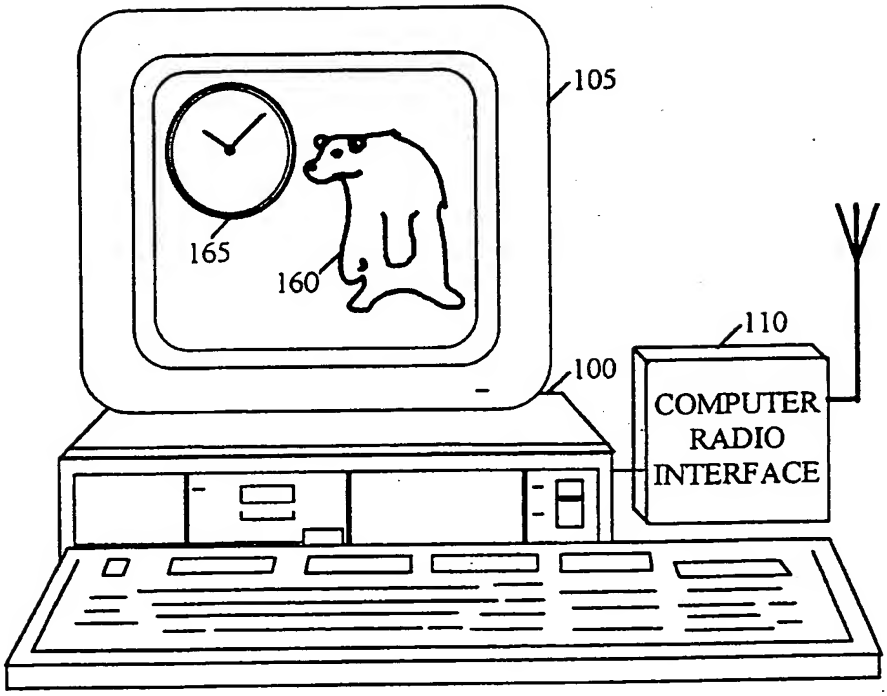


3 /150
FIGURE 1C

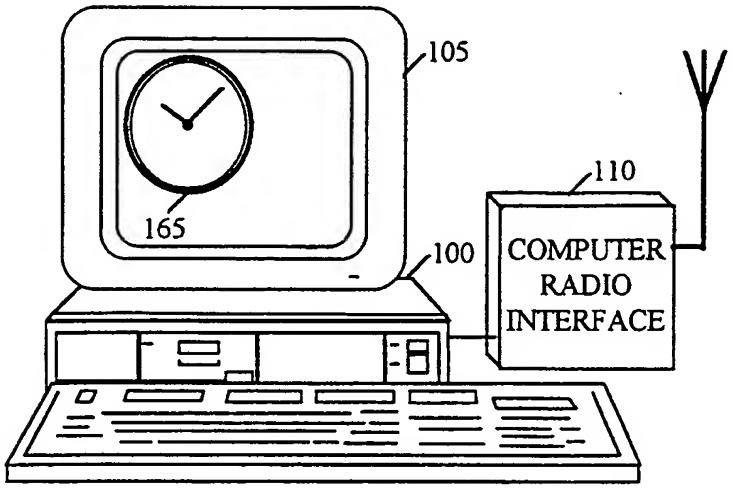


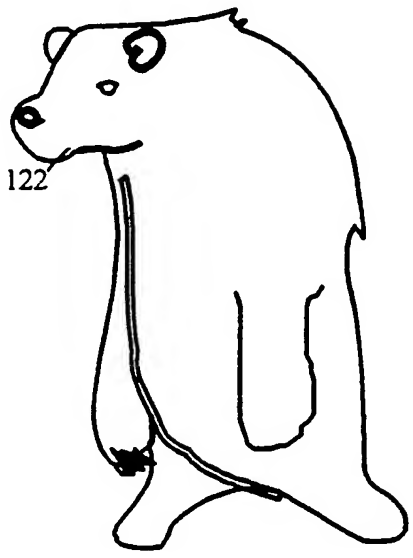
4 /150

FIGURE 2A



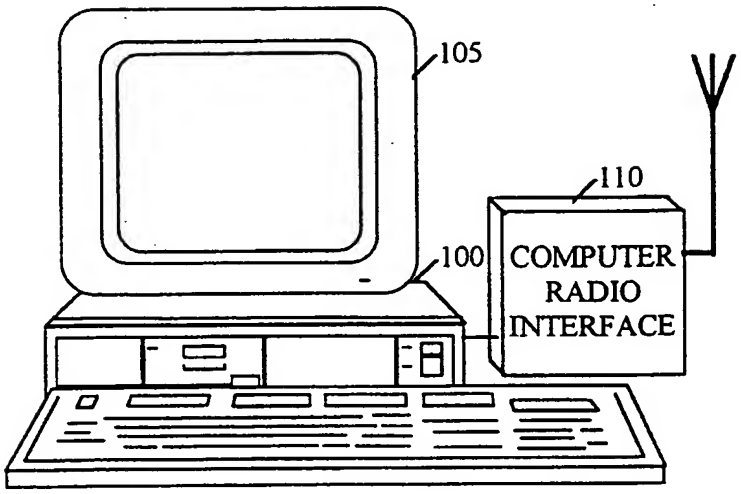
5 /150
FIGURE 2B

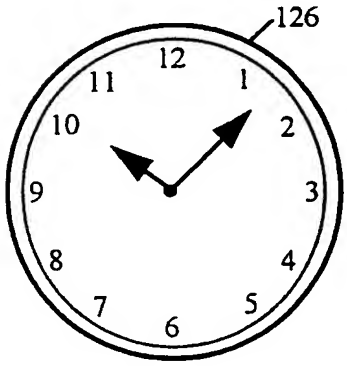


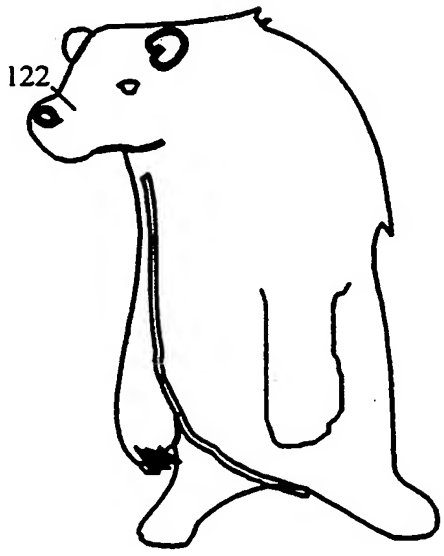


6 /150

FIGURE 2C

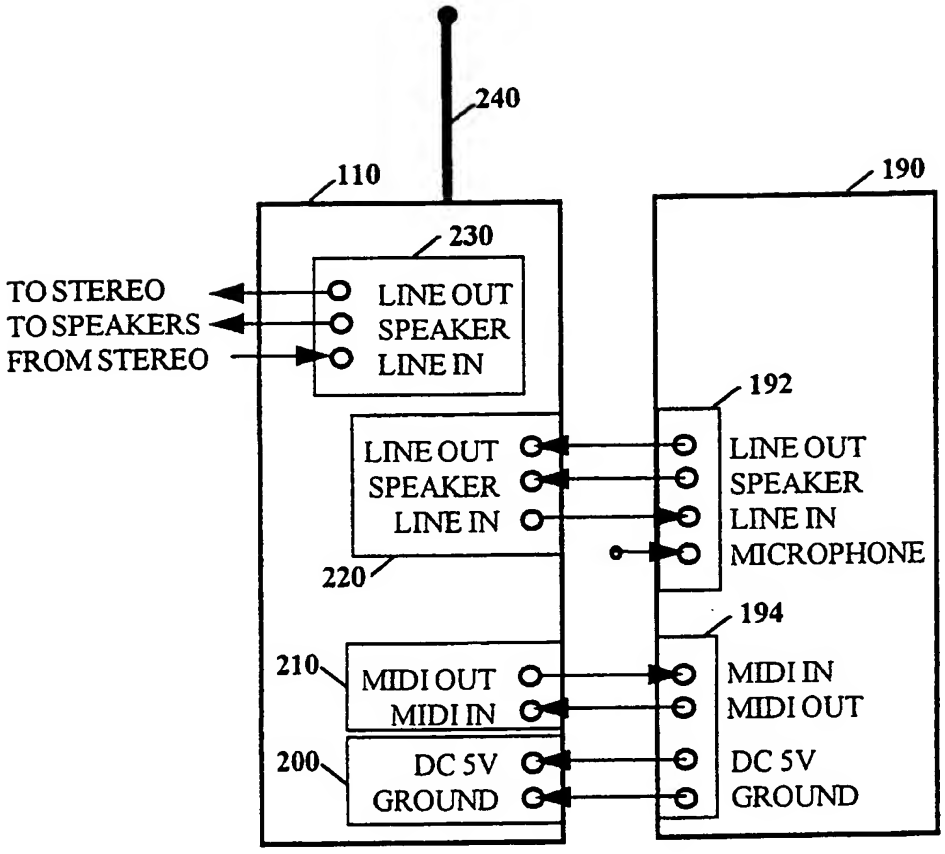




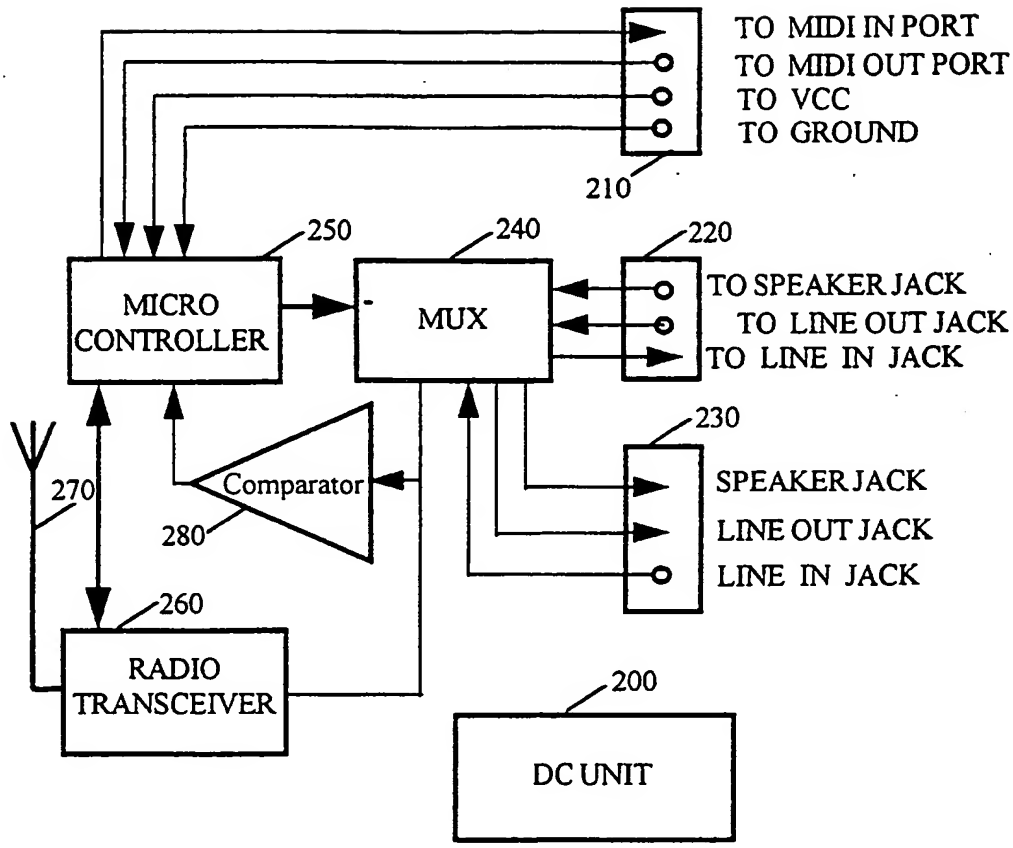


7 /150

FIGURE 3



8 /150
FIGURE 4



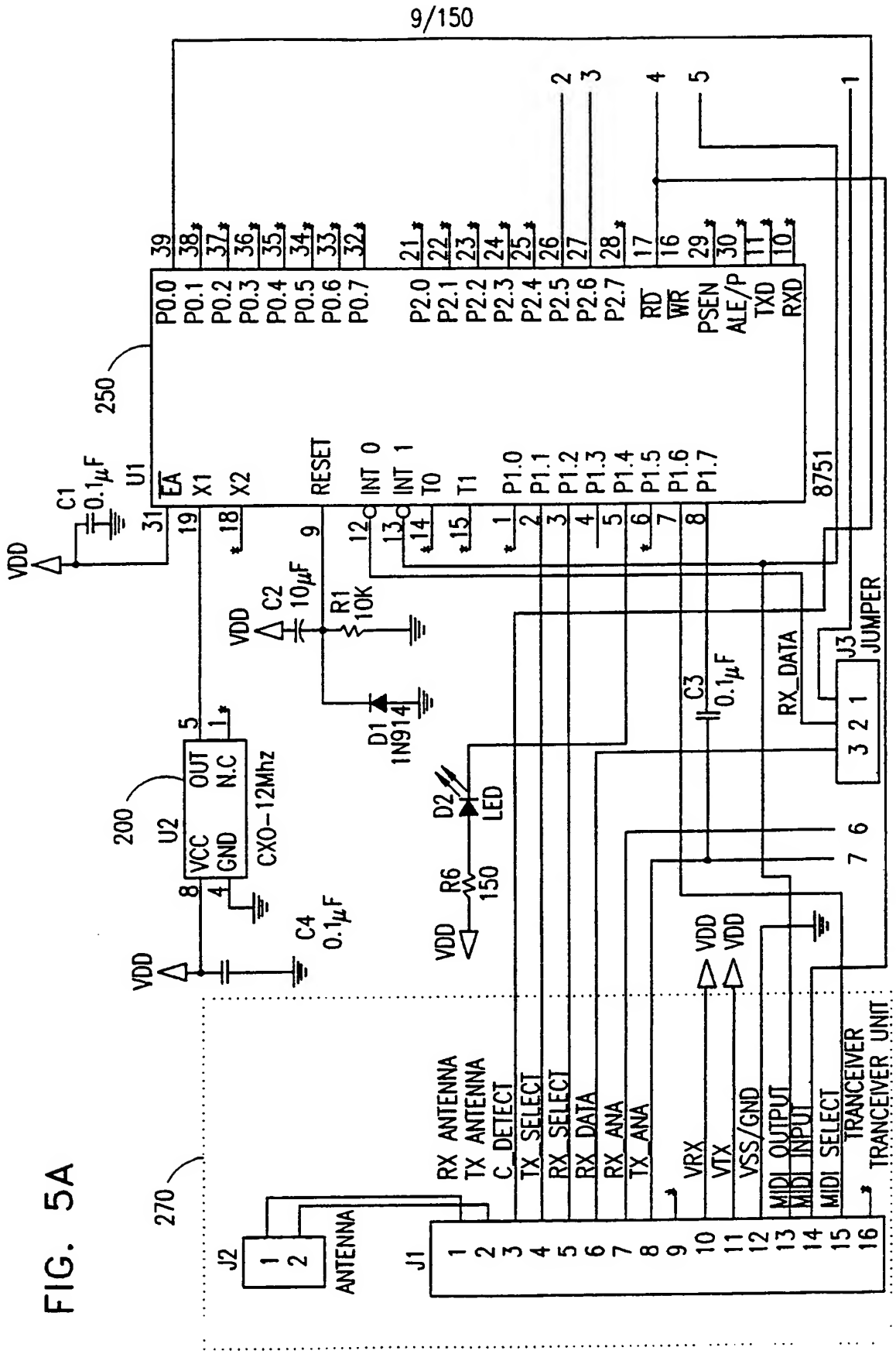
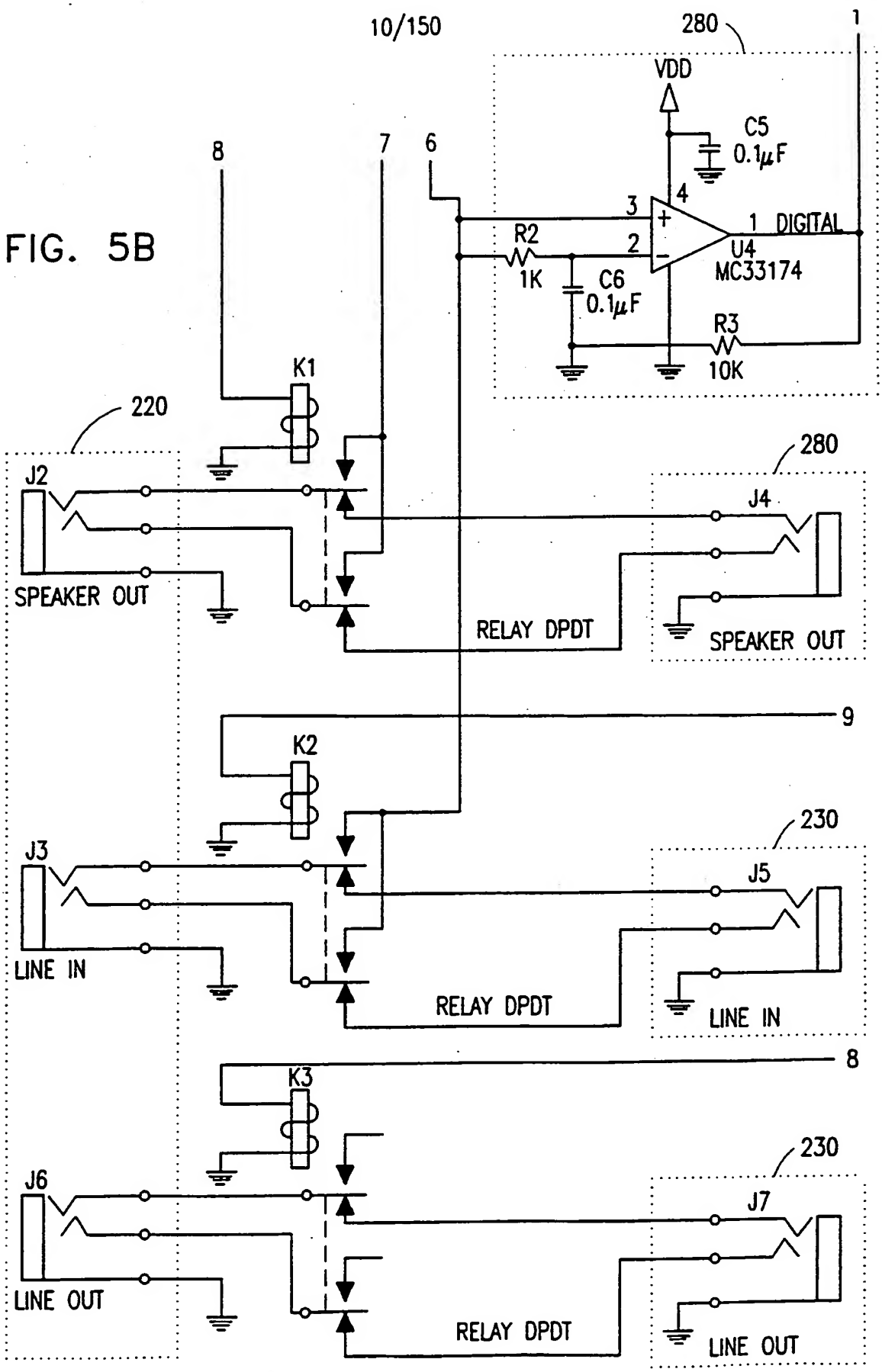

U1
8751
250
C1
0.1μF
VDD
EA
X1
X2
RESET
INT 0
INT 1
T0
T1
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
RD
WR
PSEN
ALE/P
TXD
RXD
C2
10μF
R1
10K
D1
1N914
U2
CXO-12Mhz
VCC
GND
OUT
N.C
200
C4
0.1μF
D2
LED
R6
150
C3
0.1μF
RX_DATA
J3
JUMPER
270
J2
ANTENNA
J1
RX ANTENNA
TX ANTENNA
C_DETECT
TX_SELECT
RX_SELECT
RX_DATA
RX_ANA
TX_ANA
VRX
VTX
VSS/GND
MIDI OUTPUT
MIDI INPUT
MIDI SELECT
TRANCEIVER
TRANCEIVER UNIT

FIG. 5A

FIG. 5B


280
1
VDD
C5
0.1μF
8
7
6
4
3
+
1 DIGITAL
R2
2
−
U4
MC33174
1K
C6
0.1μF
R3
10K
K1
220
280
J2
J4
SPEAKER OUT
RELAY DPDT
SPEAKER OUT
9
K2
230
J3
J5
LINE IN
RELAY DPDT
LINE IN
8
K3
230
J6
J7
LINE OUT
RELAY DPDT
LINE OUT

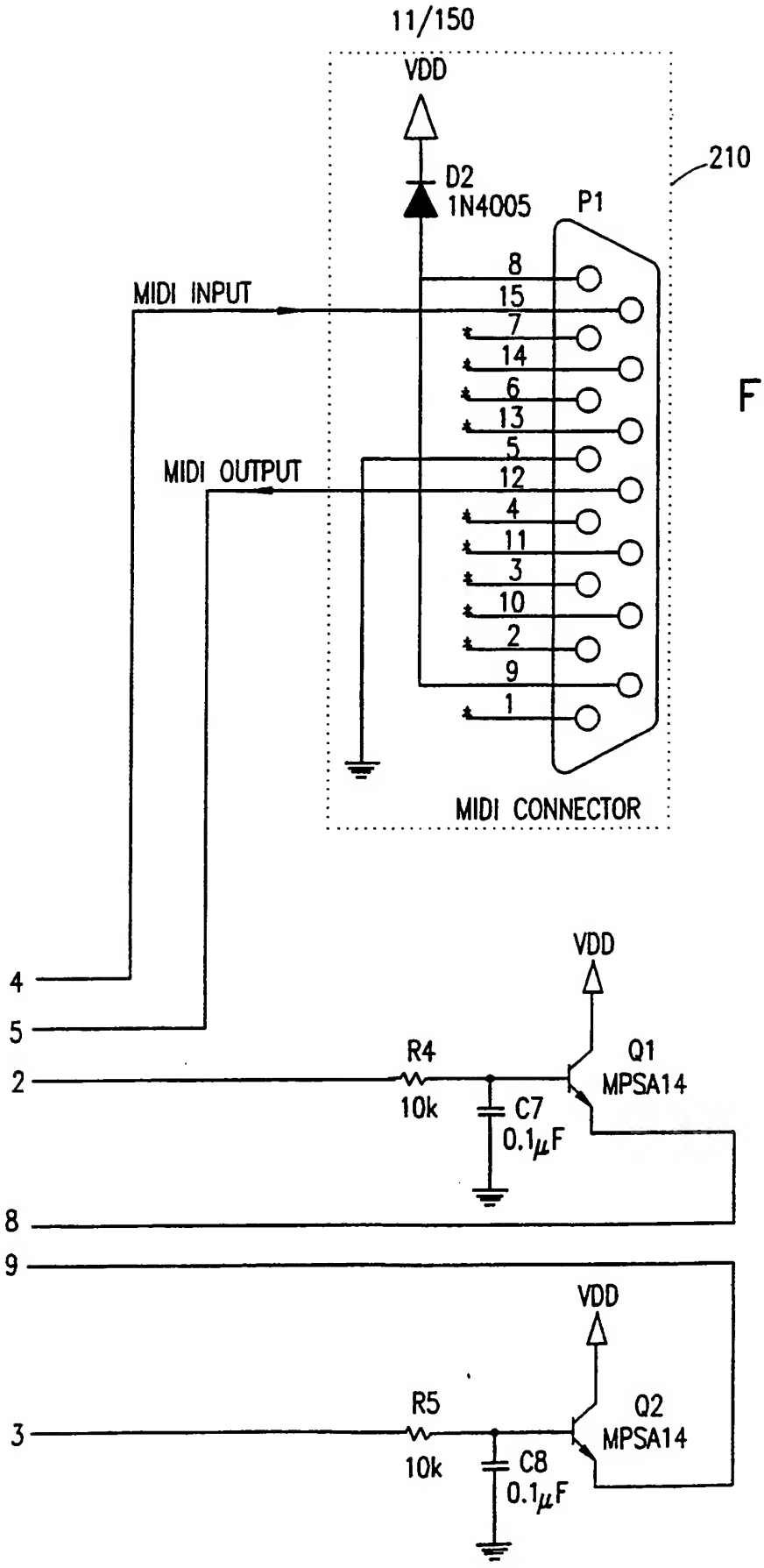

11/150
VDD
D2
1N4005
210
P1
8
15
7
14
6
13
5
12
4
11
3
10
2
9
1
MIDI INPUT
MIDI OUTPUT
MIDI CONNECTOR
4
5
2
8
9
3
R4
10k
C7
0.1μF
Q1
MPSA14
R5
10k
C8
0.1μF
Q2
MPSA14

FIG. 5C

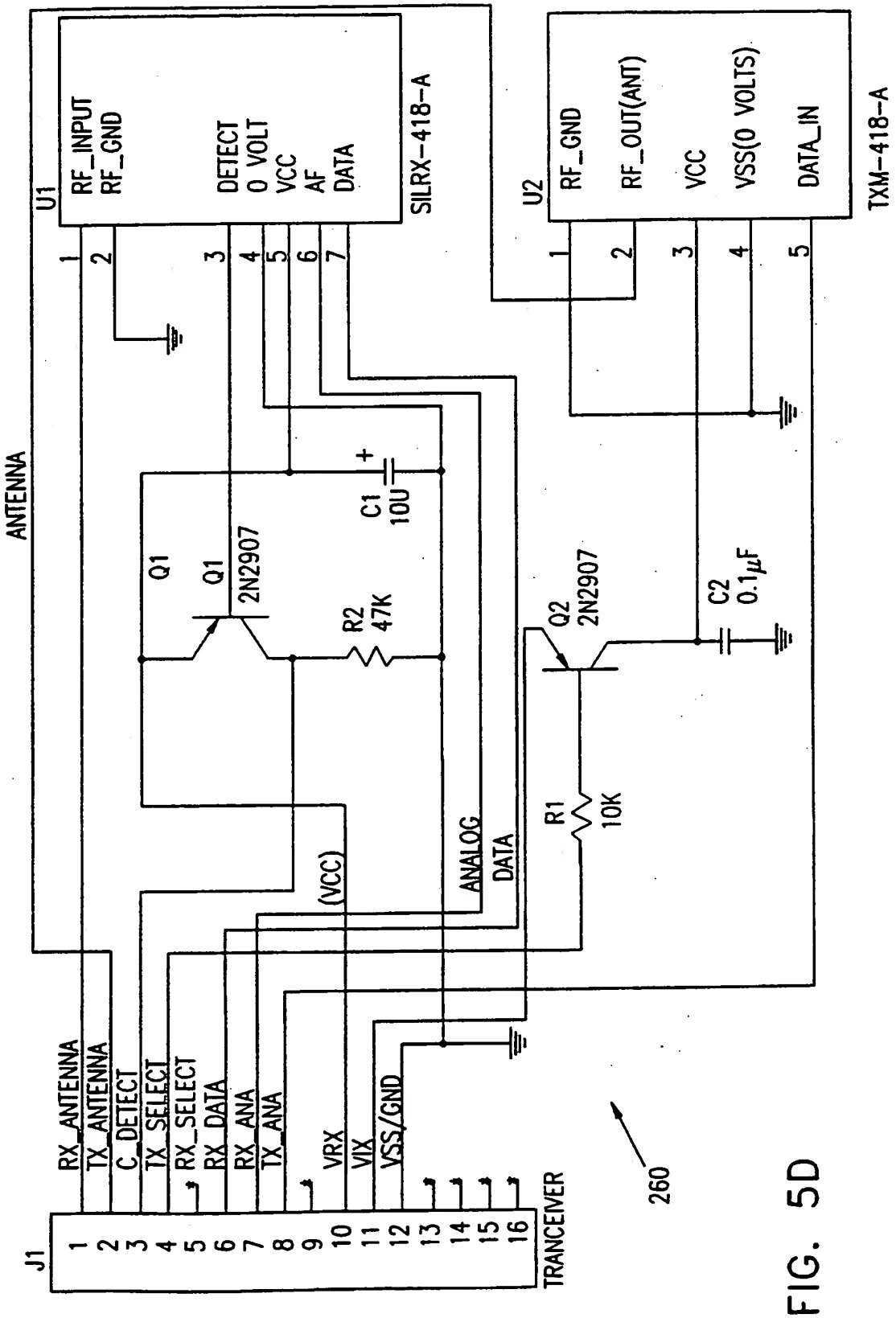

U1
RF_INPUT
RF_GND
DETECT
0 VOLT
VCC
AF
DATA
SILRX-418-A
U2
RF_GND
RF_OUT(ANT)
VCC
VSS(0 VOLTS)
DATA_IN
TXM-418-A
ANTENNA
Q1
Q1
2N2907
C1
10U
R2
47K
Q2
2N2907
C2
0.1μF
R1
10K
ANALOG
DATA
(VCC)
J1
RX_ANTENNA
TX_ANTENNA
C_DETECT
TX_SELECT
RX_SELECT
RX_DATA
RX_ANA
TX_ANA
VRX
VIX
VSS/GND
TRANCEIVER
260

FIG. 5D

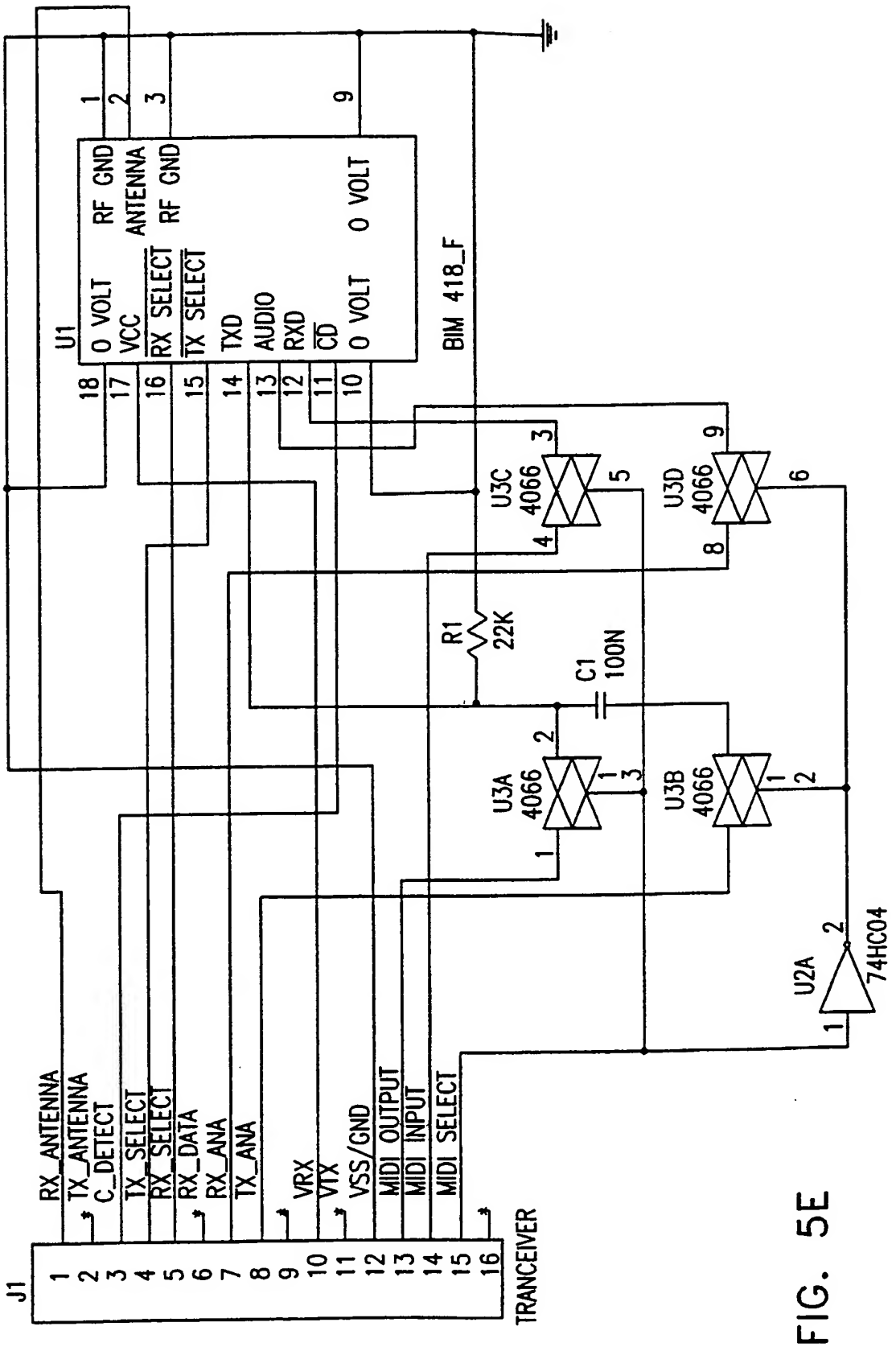
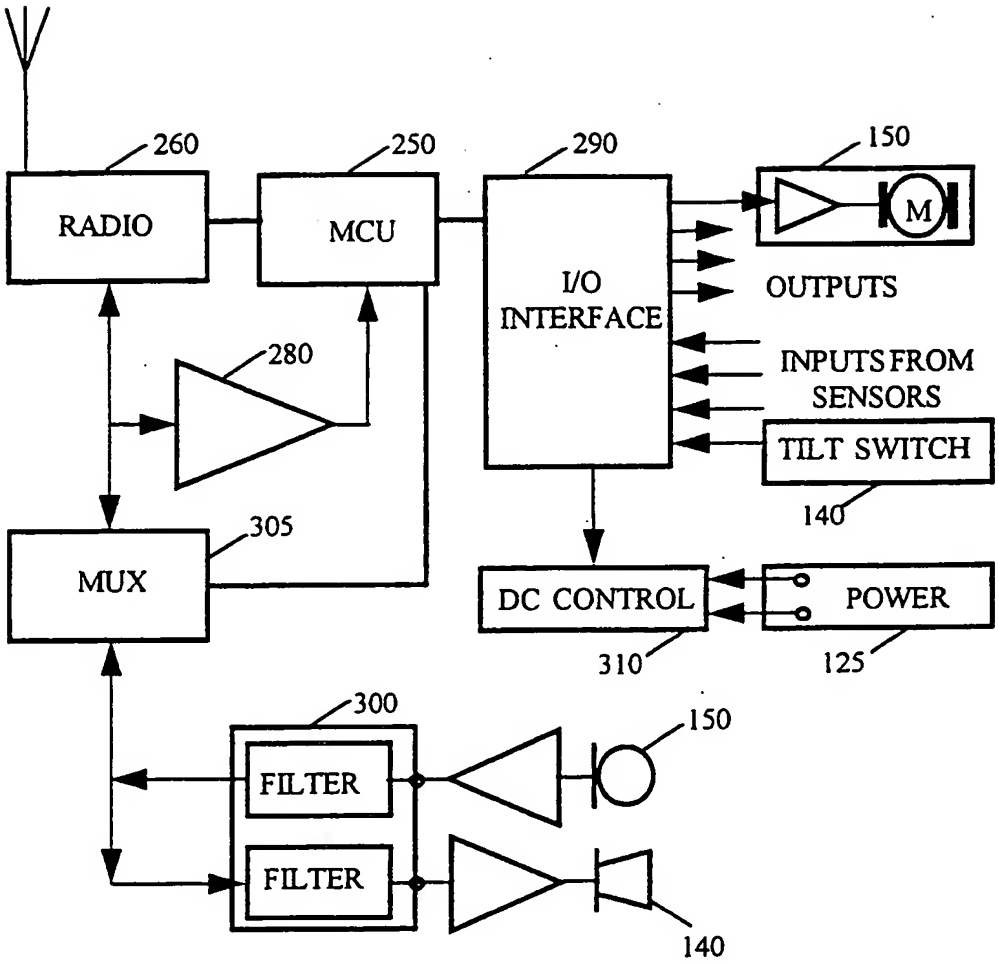

U1
BIM 418_F
0 VOLT
VCC
RX SELECT
TX SELECT
TXD
AUDIO
RXD
CD
0 VOLT
RF GND
ANTENNA
RF GND
0 VOLT
U3A 4066
U3B 4066
U3C 4066
U3D 4066
R1 22K
C1 100N
U2A 74HC04
J1
TRANCEIVER
RX_ANTENNA
TX_ANTENNA
C_DETECT
TX_SELECT
RX_SELECT
RX_DATA
RX_ANA
TX_ANA
VRX
VTX
VSS/GND
MIDI OUTPUT
MIDI INPUT
MIDI SELECT

FIG. 5E

14 /150
FIGURE 6



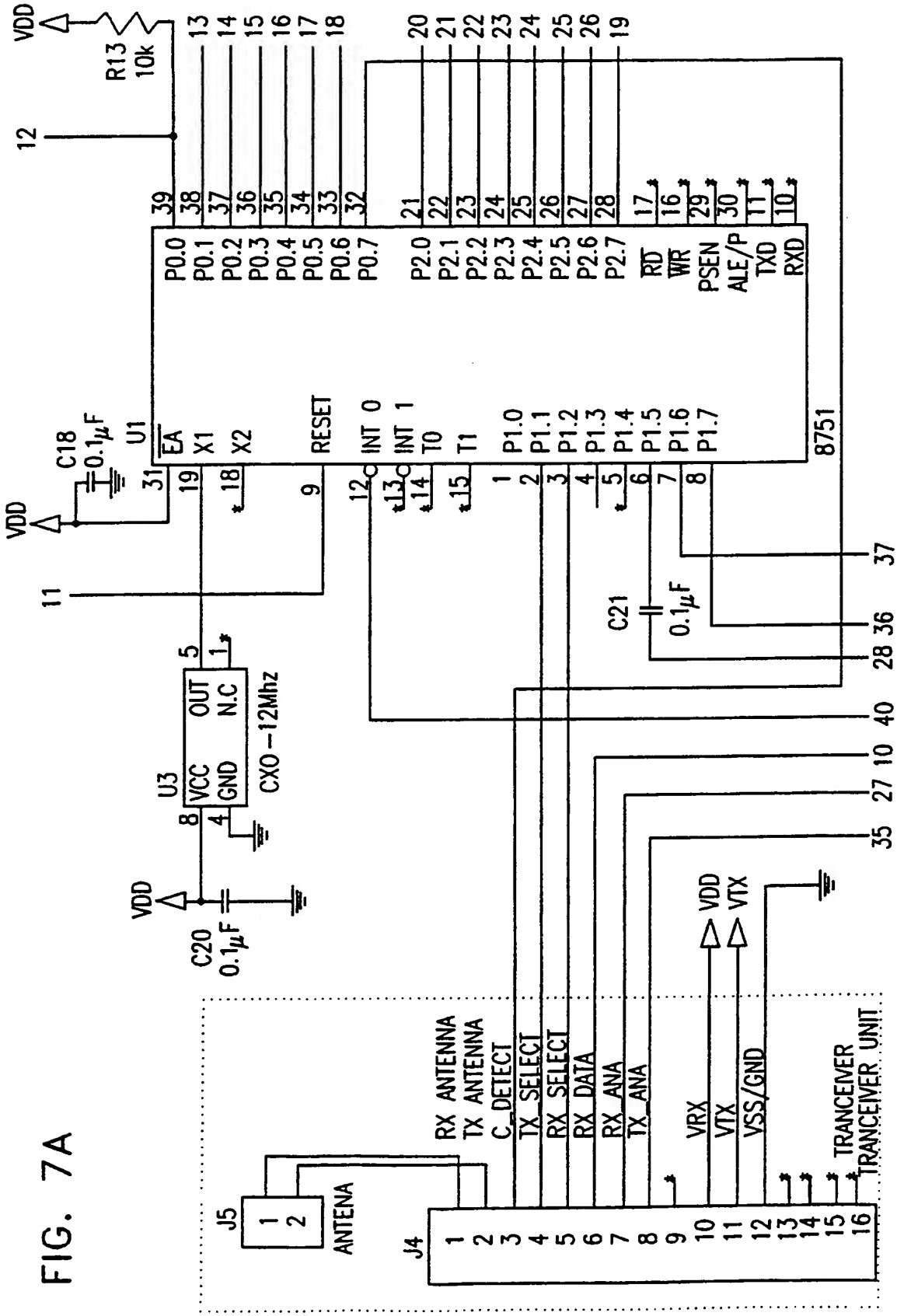
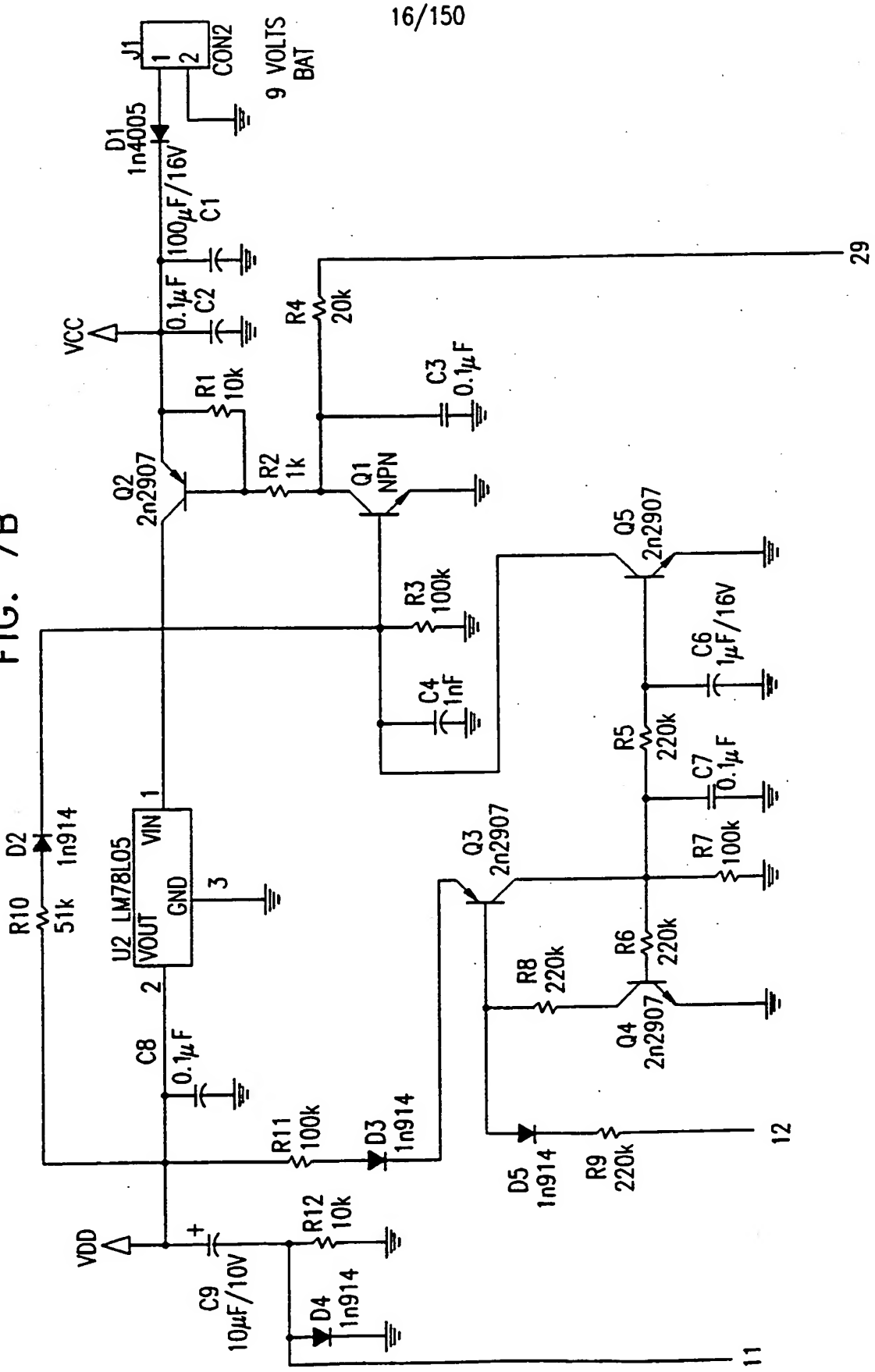

VDD
R13
10k
U1
8751
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
RD
WR
PSEN
ALE/P
TXD
RXD
EA
X1
X2
RESET
INT 0
INT 1
T0
T1
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
C18
0.1µF
C21
0.1µF
C20
0.1µF
U3
VCC
GND
OUT
N.C
CXO-12Mhz
J5
ANTENA
J4
RX ANTENNA
TX ANTENNA
C_DETECT
TX_SELECT
RX_SELECT
RX_DATA
RX_ANA
TX_ANA
VRX
VTX
VSS/GND
VDD
VTX
TRANCEIVER
TRANCEIVER UNIT

FIG. 7A

FIG. 7B


J1
CON2
9 VOLTS BAT
D1 1n4005
100µF/16V C1
0.1µF C2
VCC
R1 10k
Q2 2n2907
R2 1k
Q1 NPN
R4 20k
29
C3 0.1µF
R3 100k
C4 1nF
Q5 2n2907
C6 1µF/16V
R5 220k
C7 0.1µF
R7 100k
Q3 2n2907
R6 220k
R8 220k
Q4 2n2907
D2 1n914
R10 51k
U2 LM78L05
VIN
GND
VOUT
C8 0.1µF
R11 100k
D3 1n914
D5 1n914
R9 220k
12
VDD
C9 10µF/10V
R12 10k
D4 1n914
11

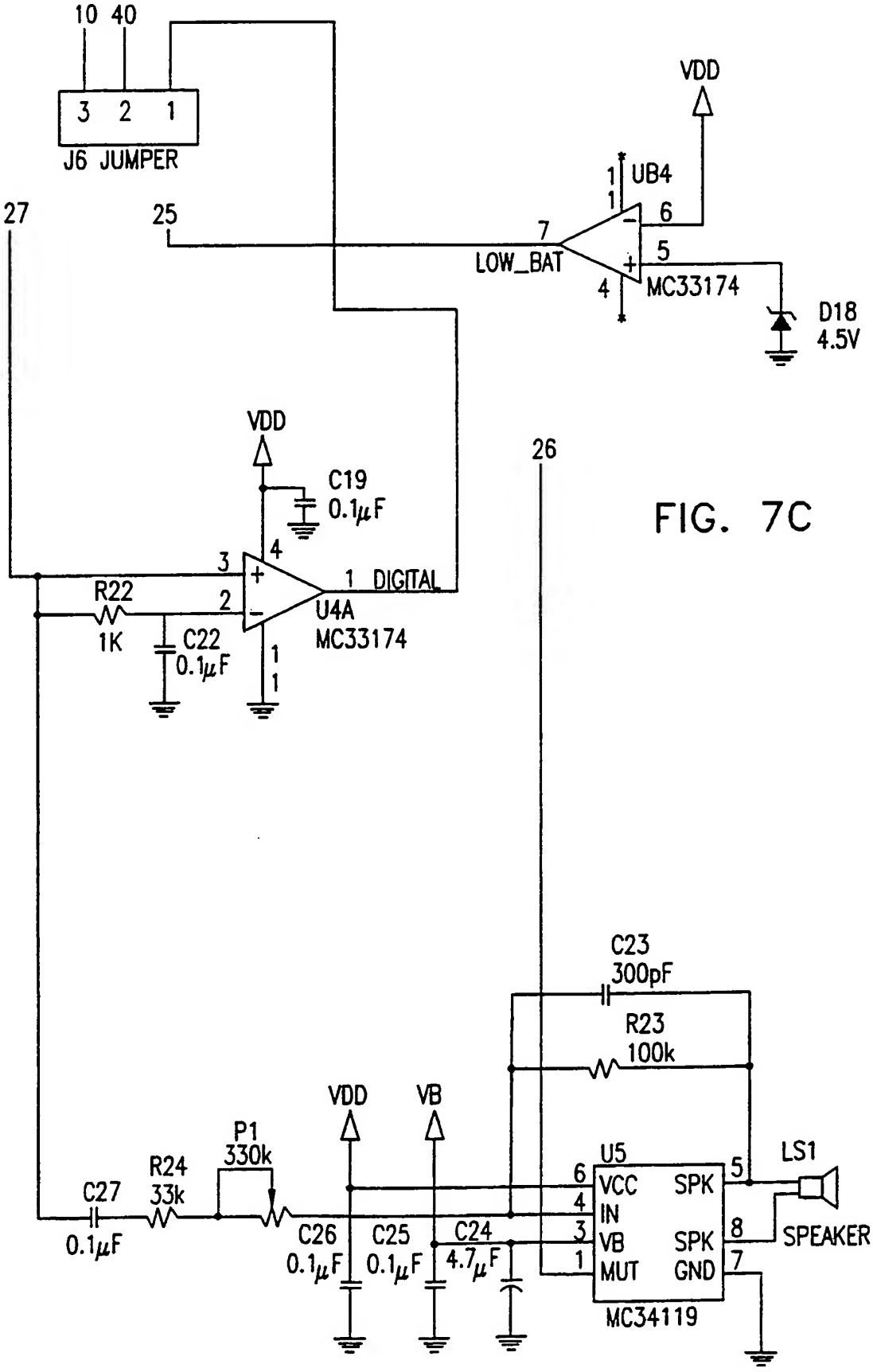

10 40
3 2 1
J6 JUMPER
VDD
UB4
27
25
7
LOW_BAT
6
5
4
MC33174
D18
4.5V
VDD
C19
0.1μF
26
3
4
1 DIGITAL
R22
2
1K
U4A
MC33174
C22
0.1μF
1
1
C23
300pF
R23
100k
VDD
VB
P1
330k
U5
LS1
R24
33k
6
VCC
SPK
5
C27
4
IN
0.1μF
C26
C25
C24
3
VB
SPK
8
SPEAKER
0.1μF
0.1μF
4.7μF
1
MUT
GND
7
MC34119

FIG. 7C

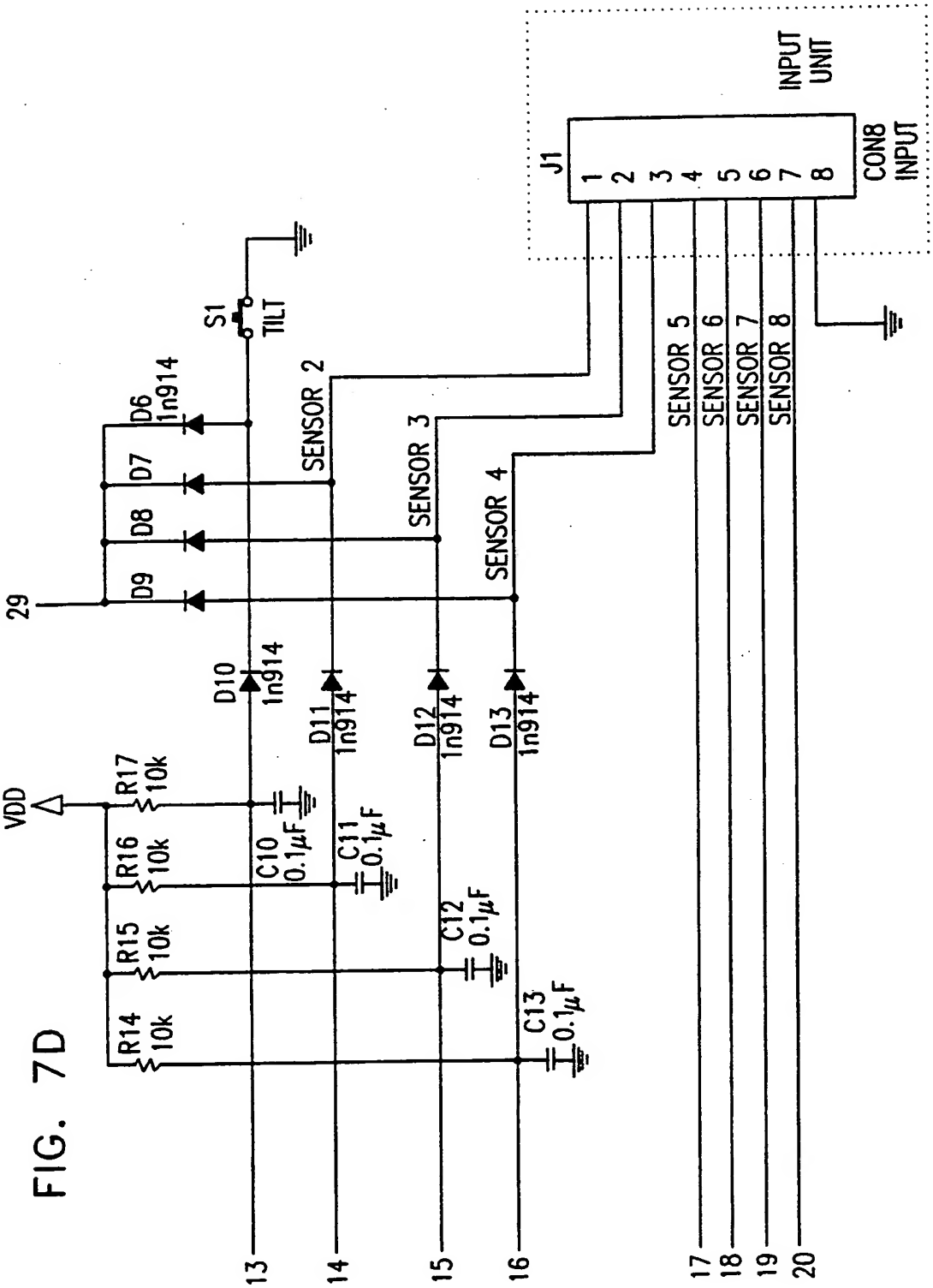

INPUT UNIT
J1
CON8 INPUT
1
2
3
4
5
6
7
8
S1
TILT
D6 1n914
D7
D8
D9
29
SENSOR 2
SENSOR 3
SENSOR 4
SENSOR 5
SENSOR 6
SENSOR 7
SENSOR 8
D10 1n914
D11 1n914
D12 1n914
D13 1n914
VDD
R17 10k
R16 10k
R15 10k
R14 10k
C10 0.1μF
C11 0.1μF
C12 0.1μF
C13 0.1μF
13
14
15
16
17
18
19
20

FIG. 7D

FIG. 7E

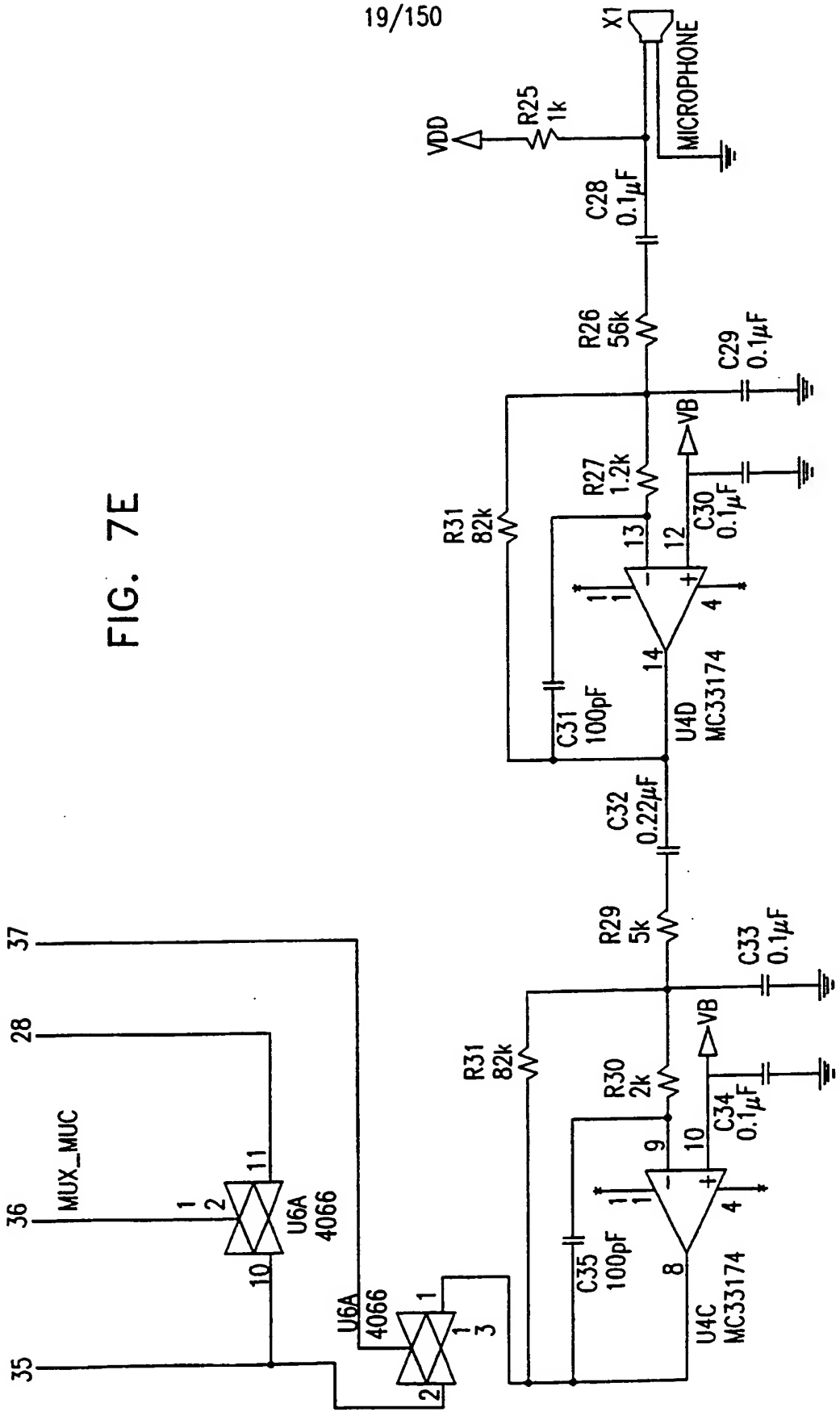
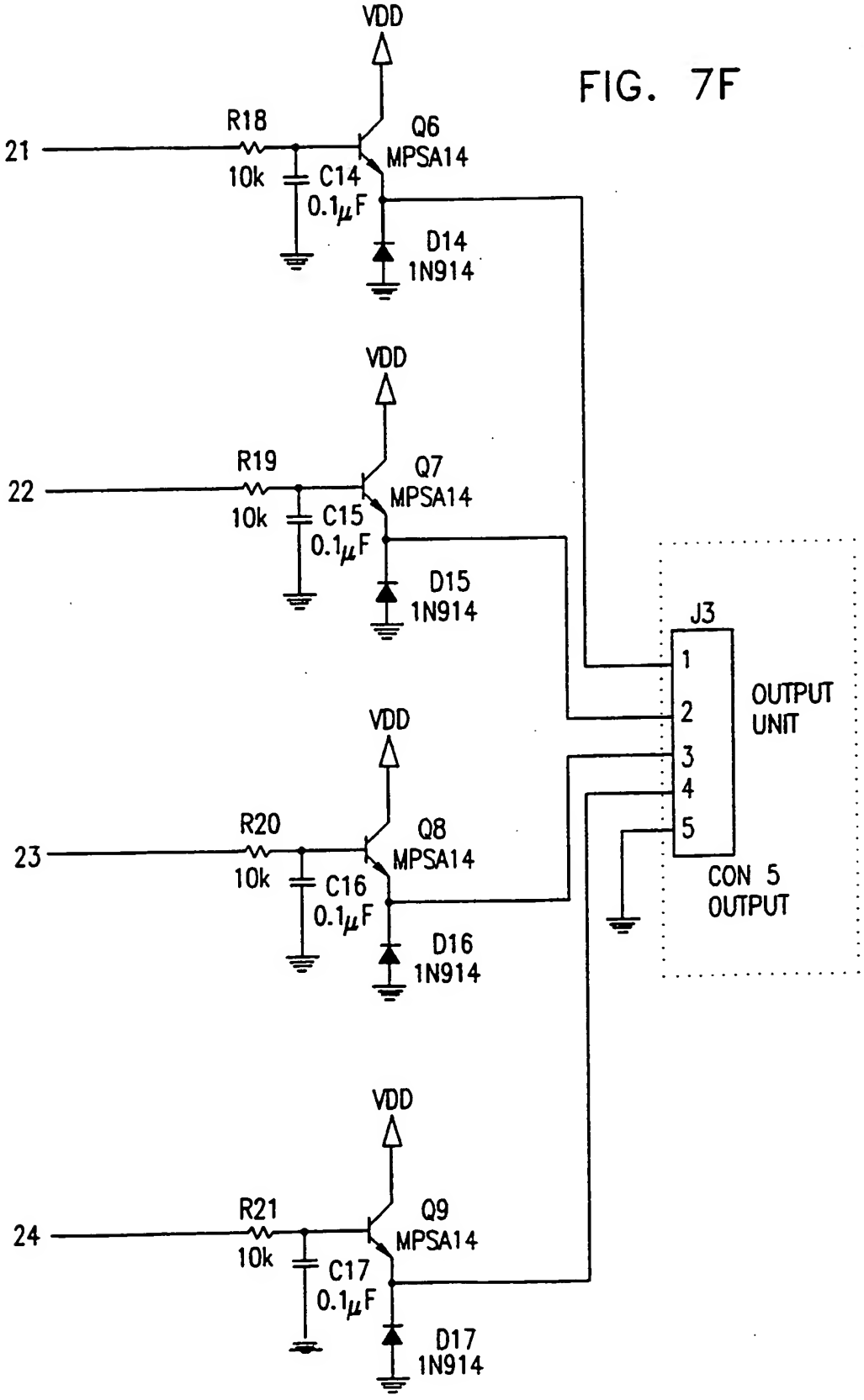
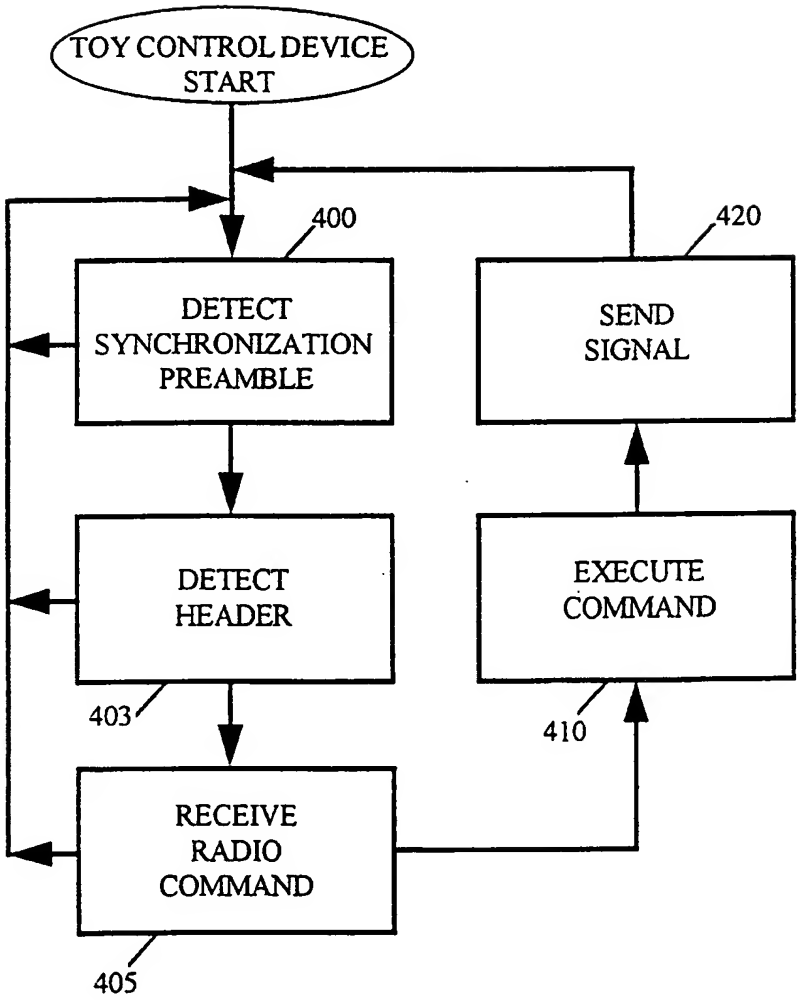

X1
MICROPHONE
VDD
R25
1k
C28
0.1µF
R26
56k
C29
0.1µF
VB
R27
1.2k
C30
0.1µF
R31
82k
13
12
14
U4D
MC33174
C31
100pF
C32
0.22µF
R29
5k
C33
0.1µF
R31
82k
R30
2k
C34
0.1µF
9
10
8
U4C
MC33174
C35
100pF
37
28
36
35
MUX_MUC
U6A
4066
U6A
4066

FIG. 7F

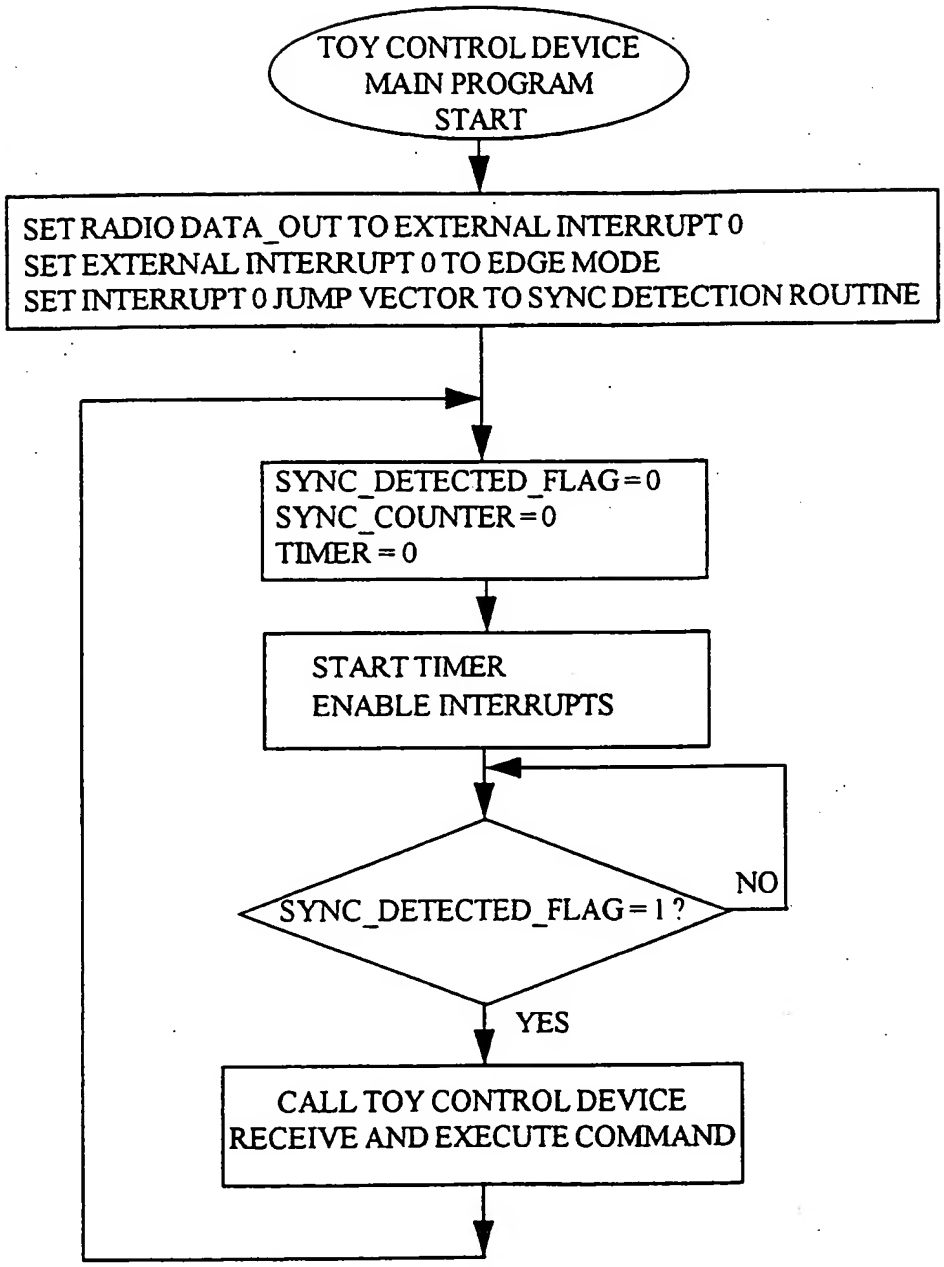

VDD
R18
10k
C14
0.1μF
Q6
MPSA14
21
D14
1N914
VDD
R19
10k
C15
0.1μF
Q7
MPSA14
22
D15
1N914
VDD
R20
10k
C16
0.1μF
Q8
MPSA14
23
D16
1N914
VDD
R21
10k
C17
0.1μF
Q9
MPSA14
24
D17
1N914
J3
1
2
3
4
5
OUTPUT
UNIT
CON 5
OUTPUT

21 /150
FIGURE 8A

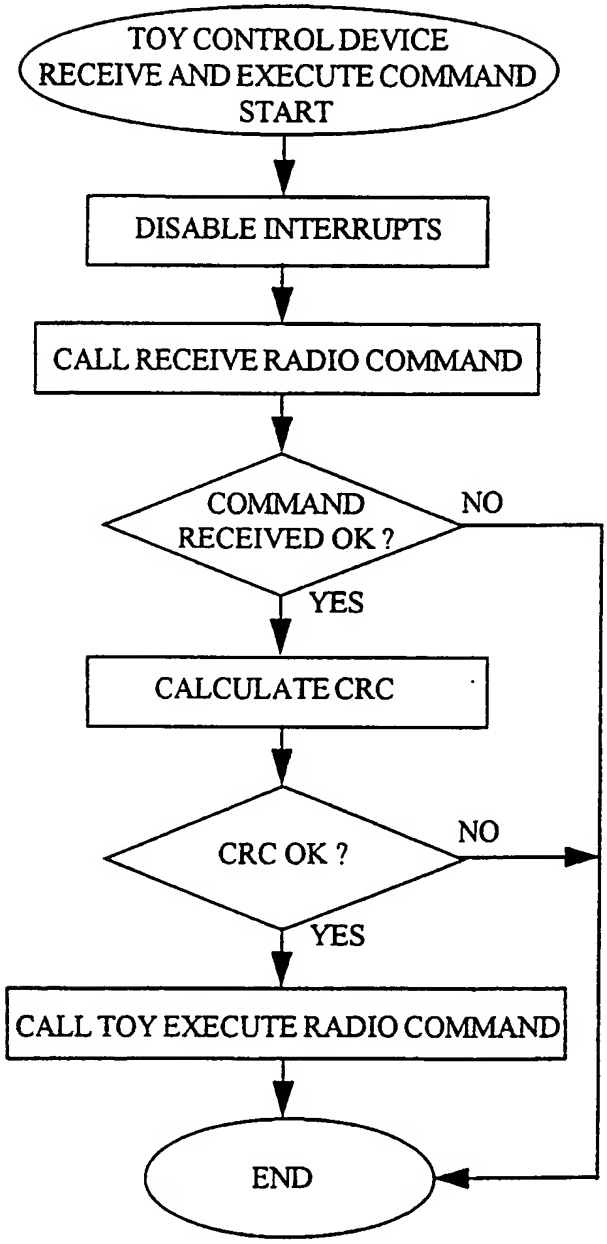


22 /150

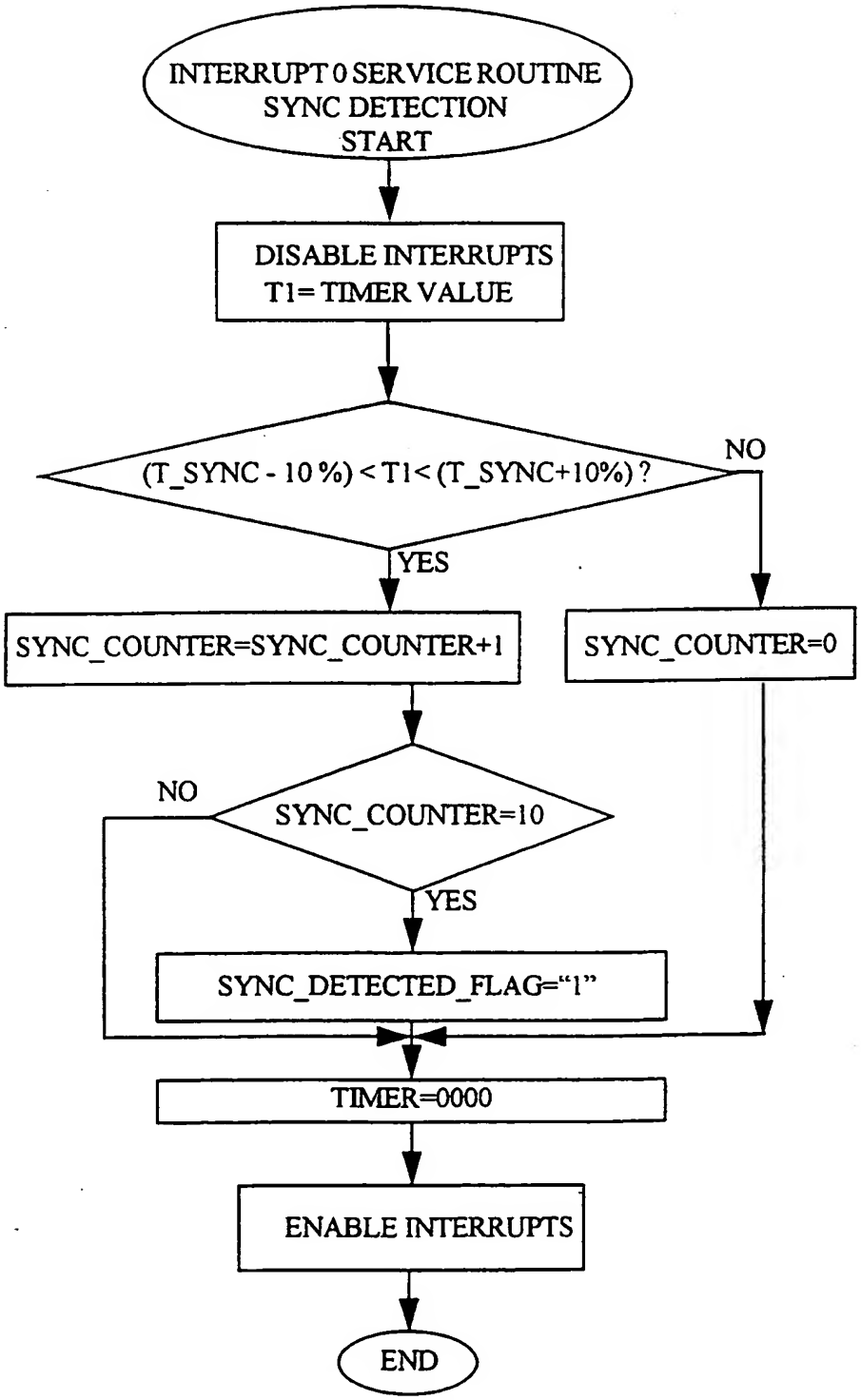
FIGURE 8B



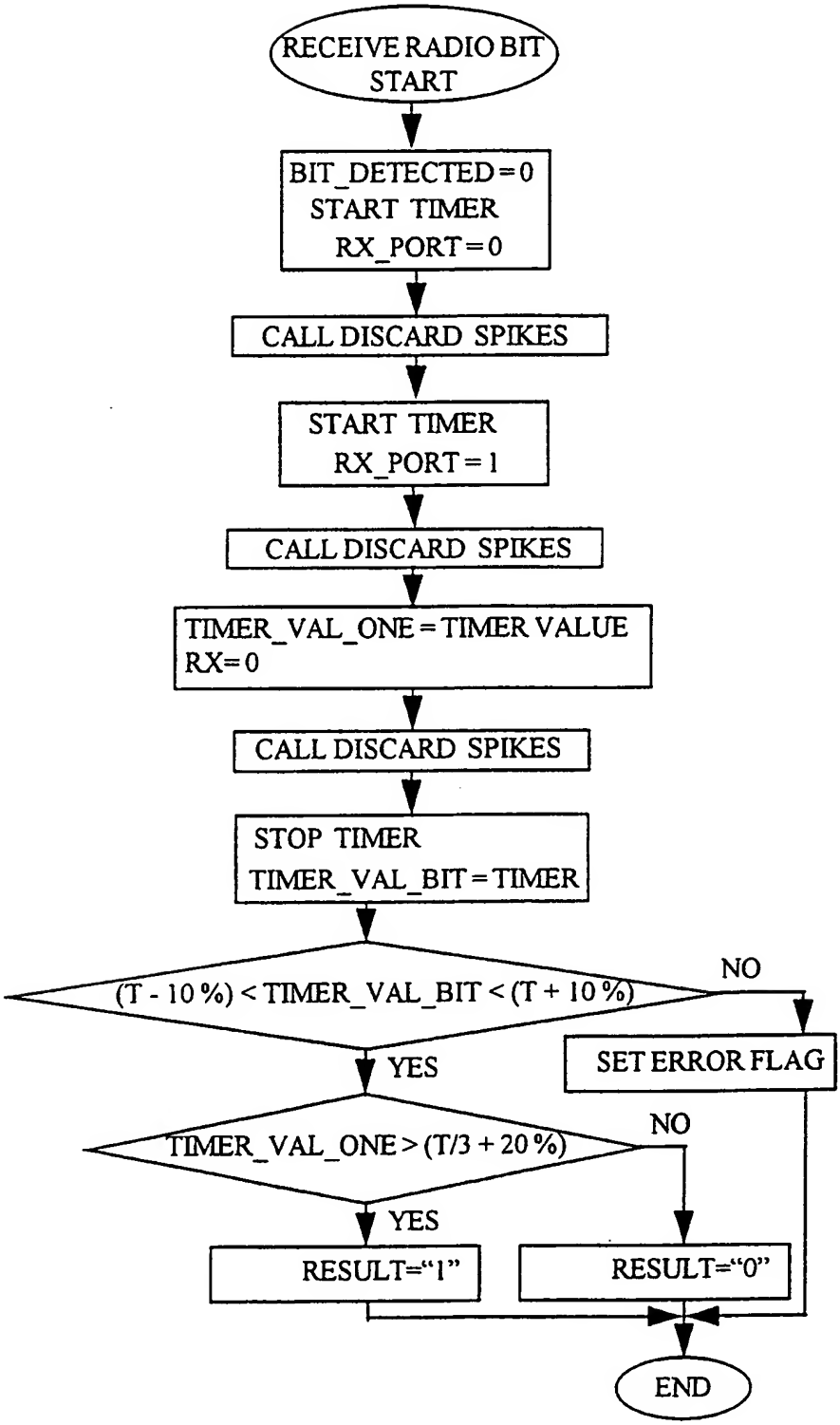
23 /150
FIGURE 8C



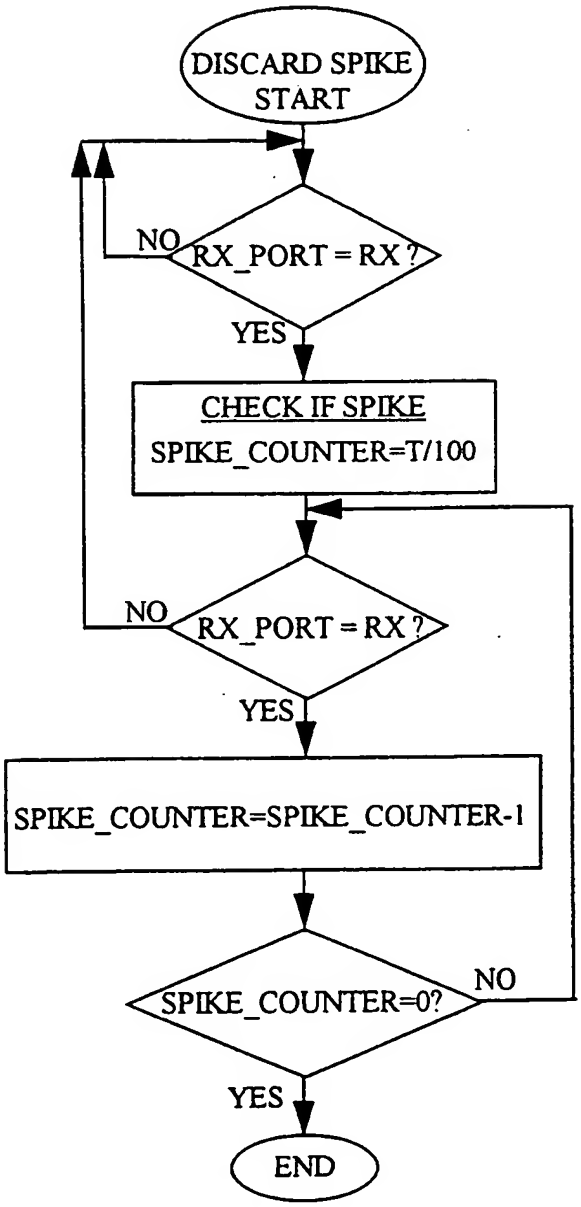
24 /150
FIGURE 8D



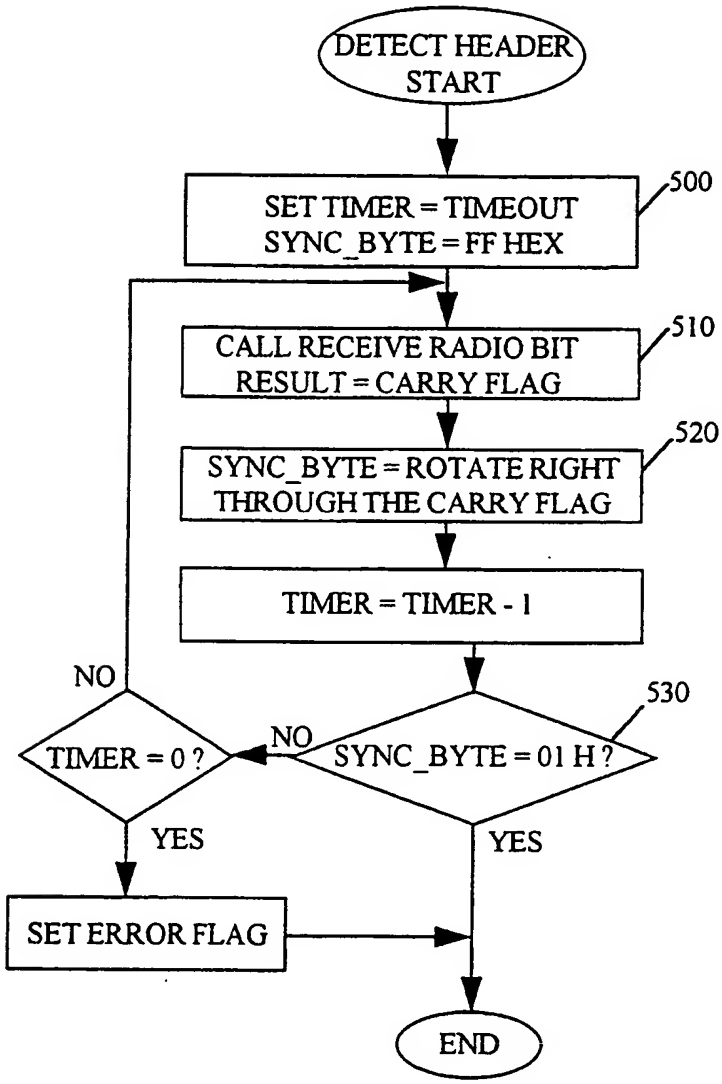
25 /150
FIGURE 8E



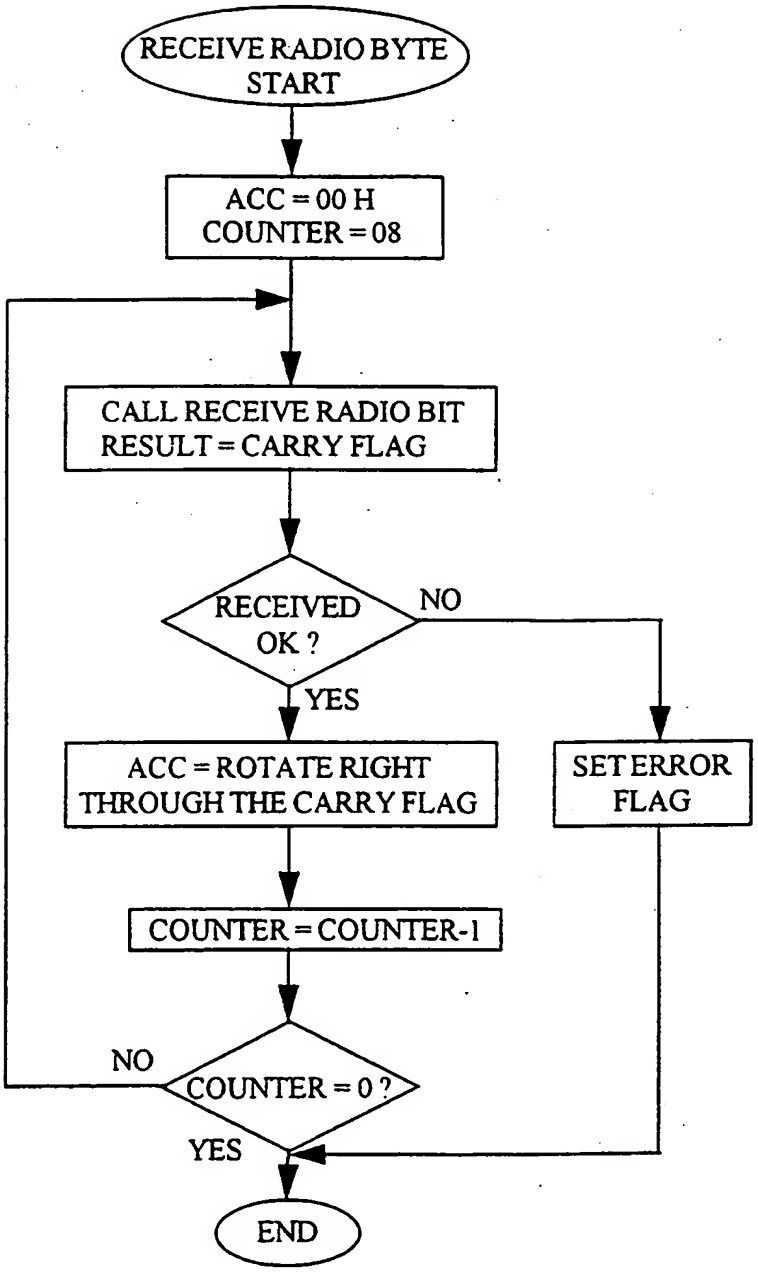
26 /150
FIGURE 8F



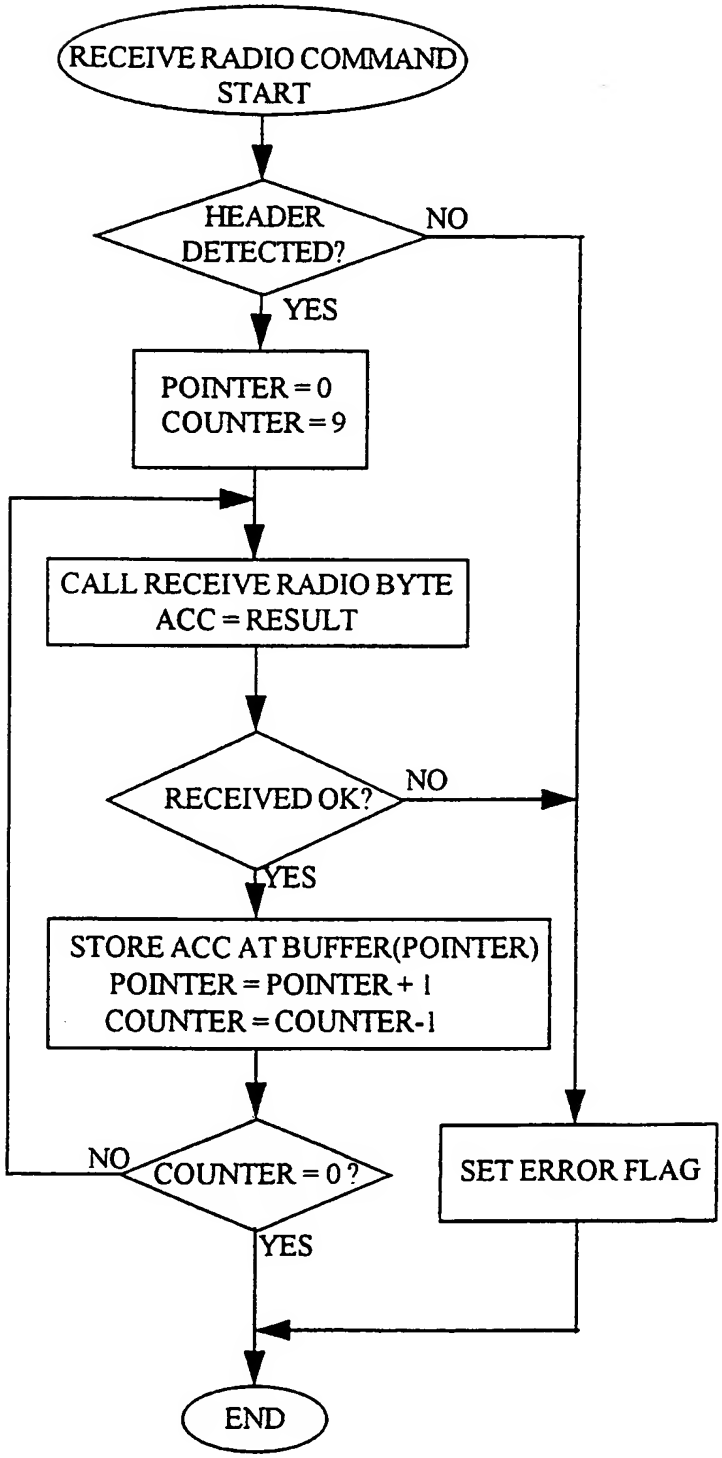
27 /150
FIGURE 8G



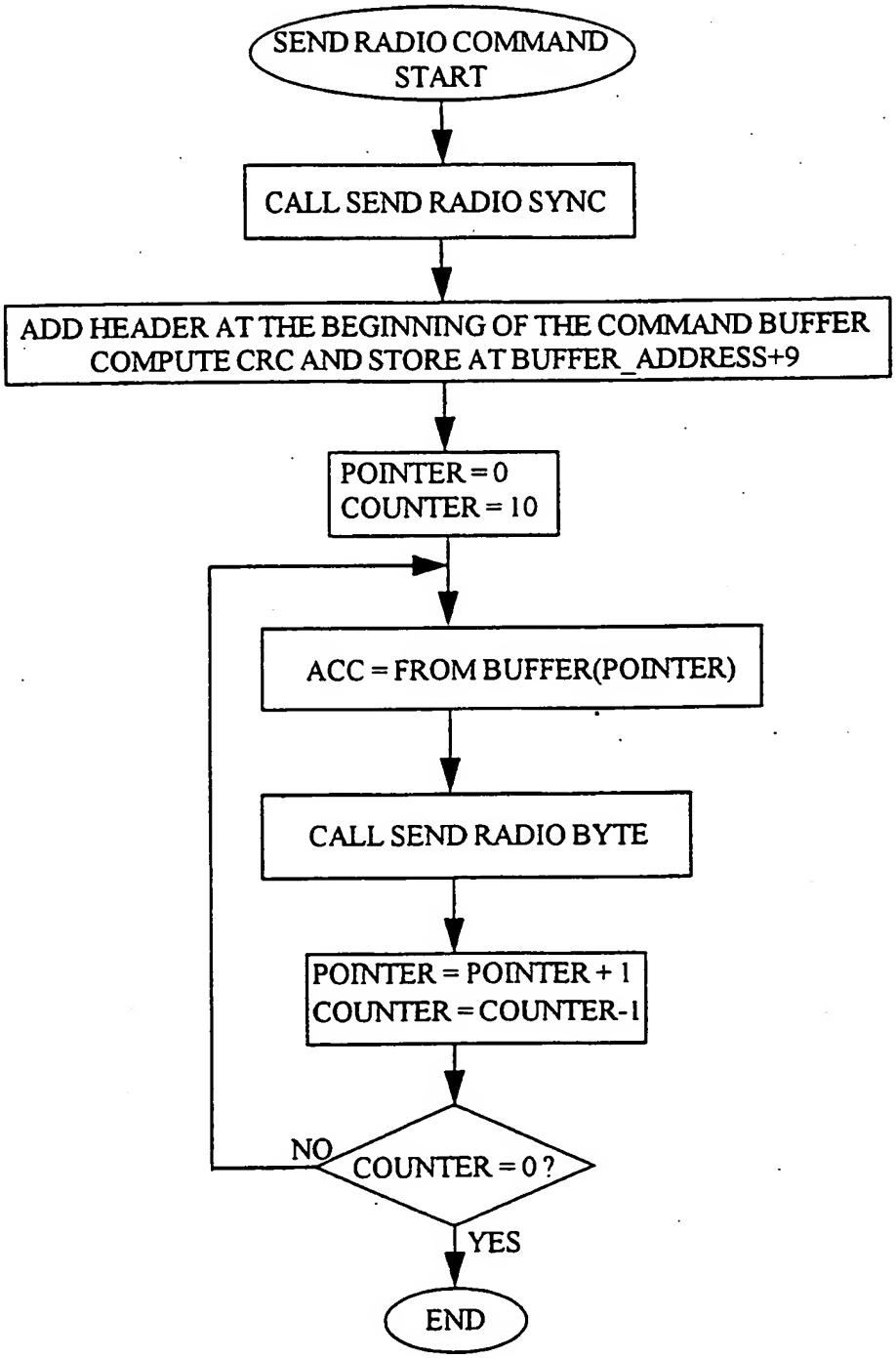
28 /150
FIGURE 8H



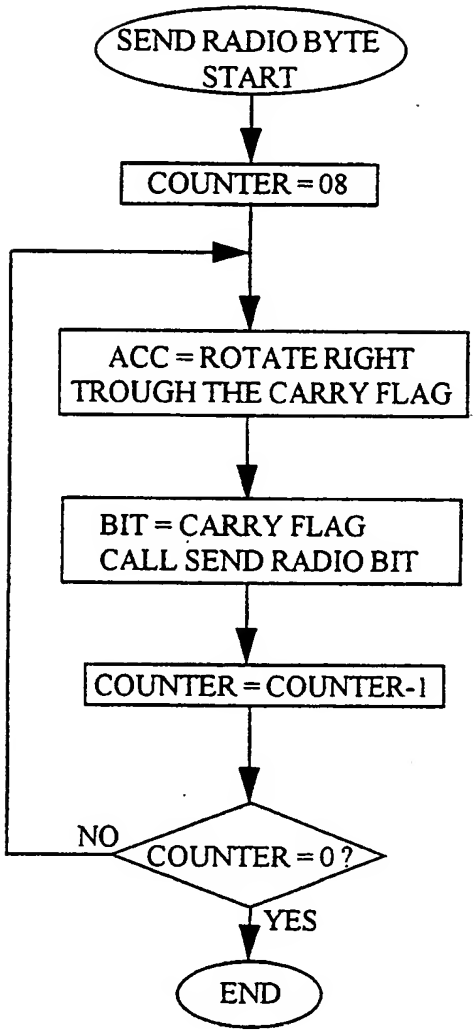
29 /150
FIGURE 8I



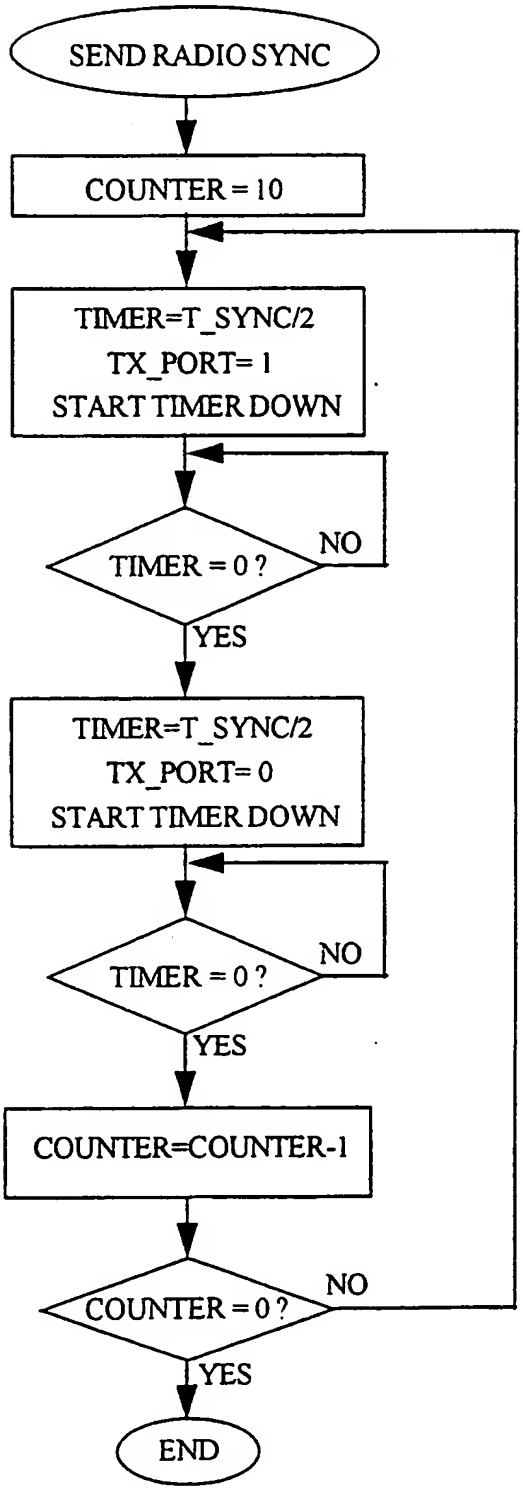
30 /150
FIGURE 8J



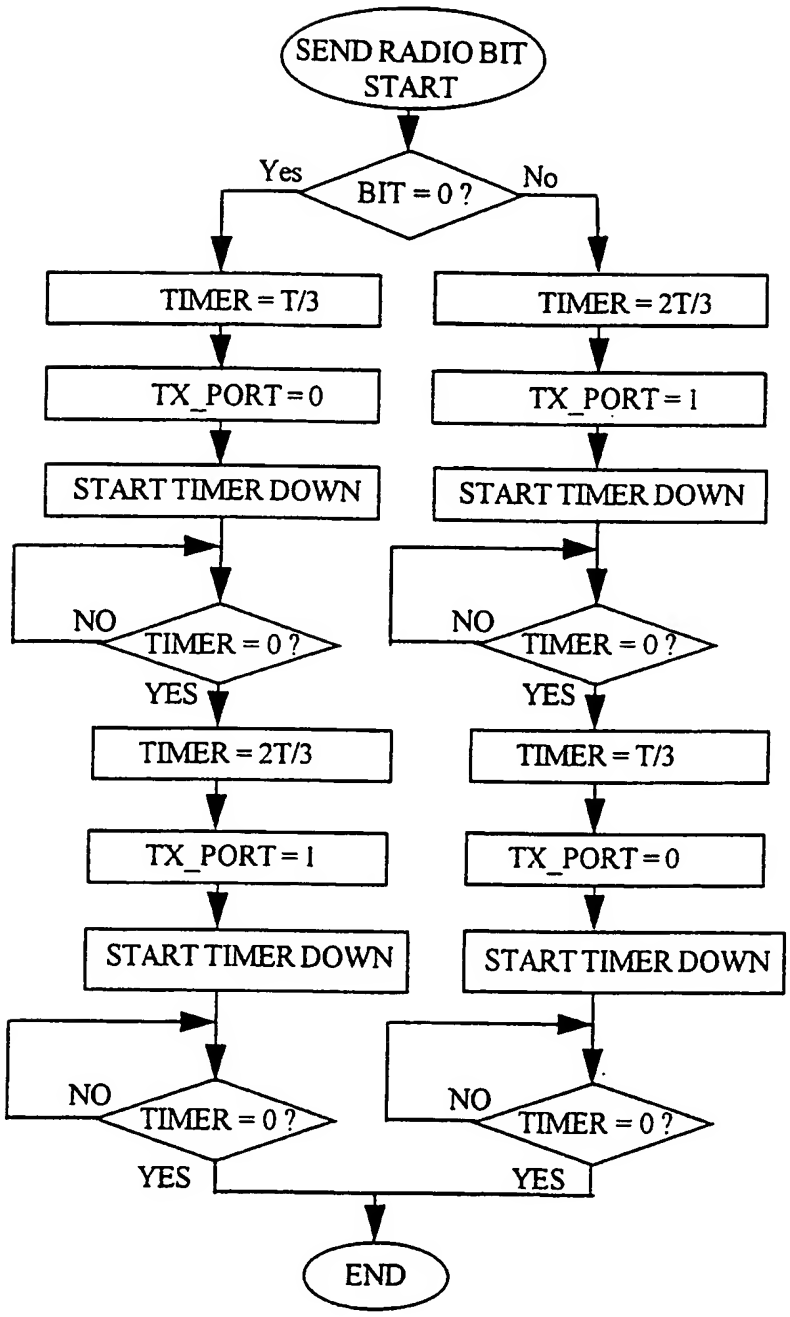
31 /150
FIGURE 8K



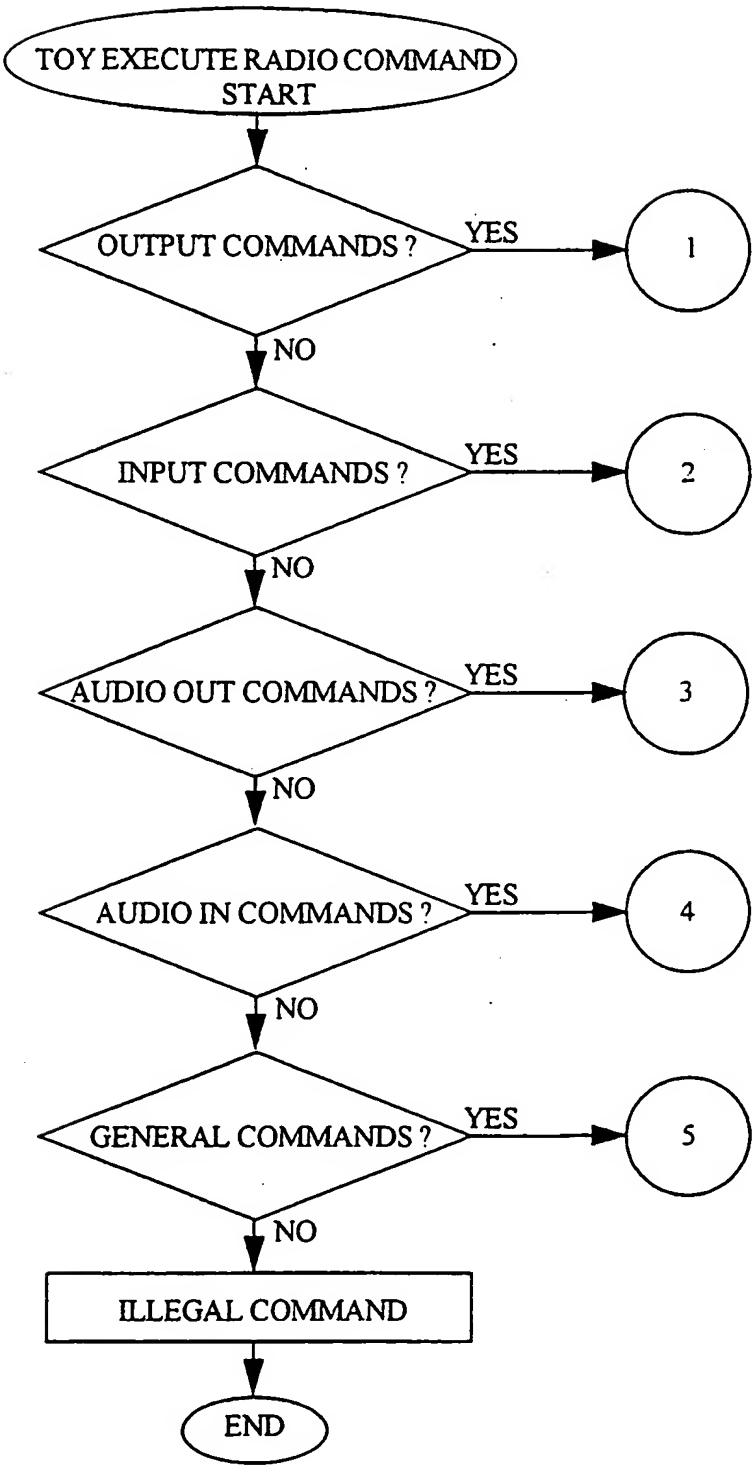
32 /150
FIGURE 8L



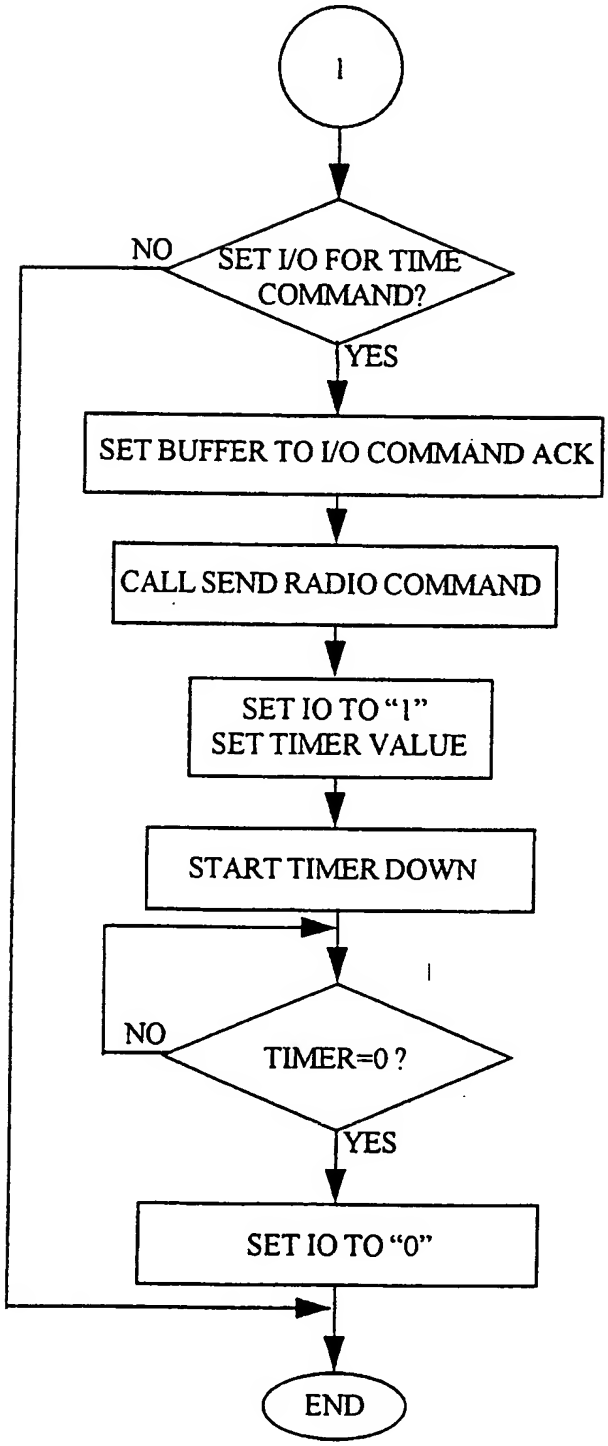
33 /150
FIGURE 8M



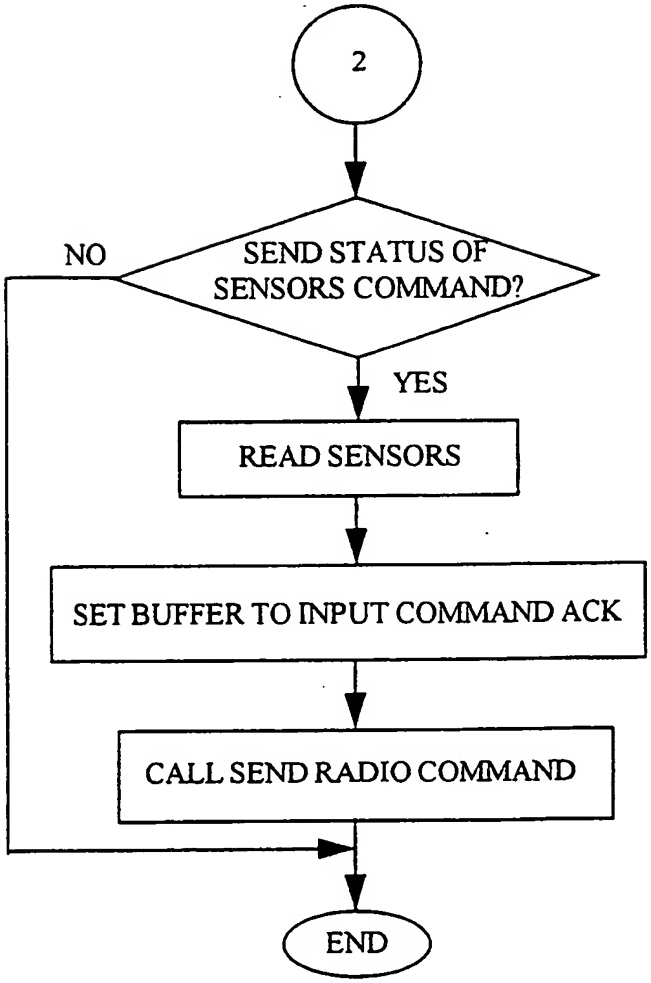
34 /150
FIGURE 8N



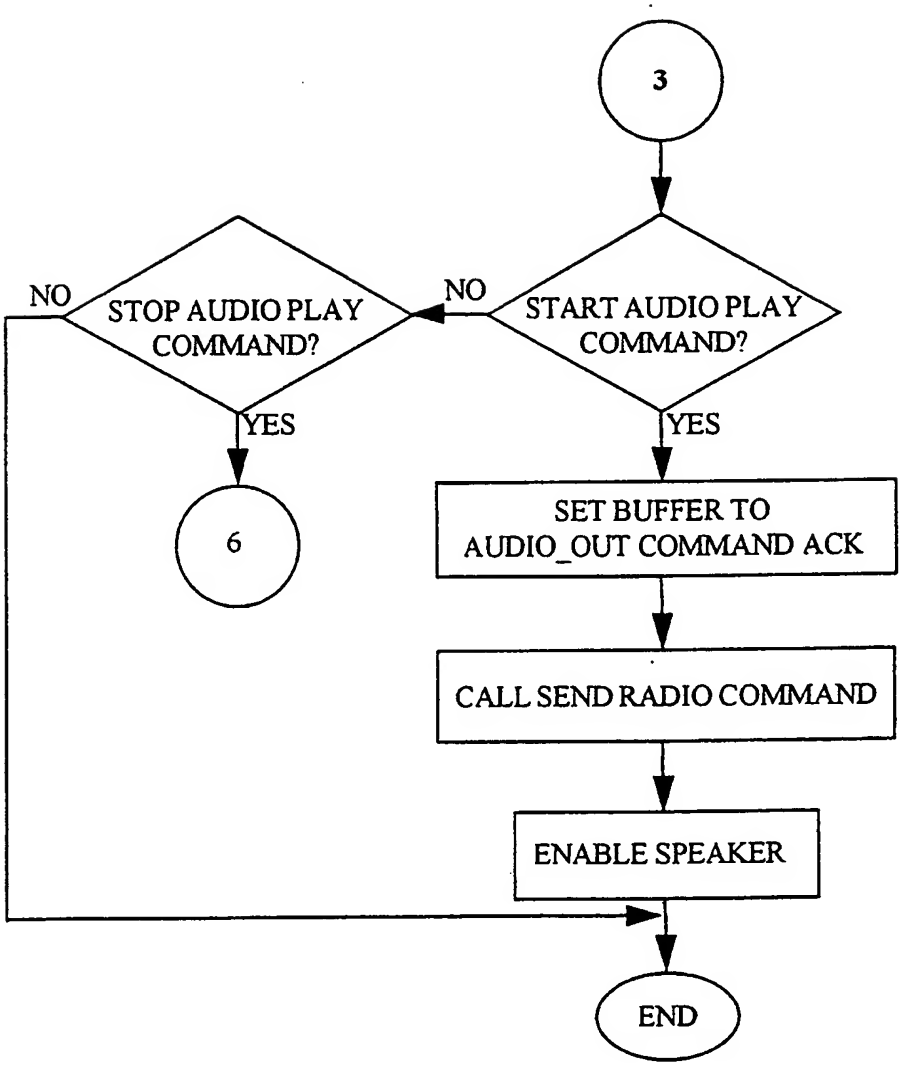
35 /150
FIGURE 8O



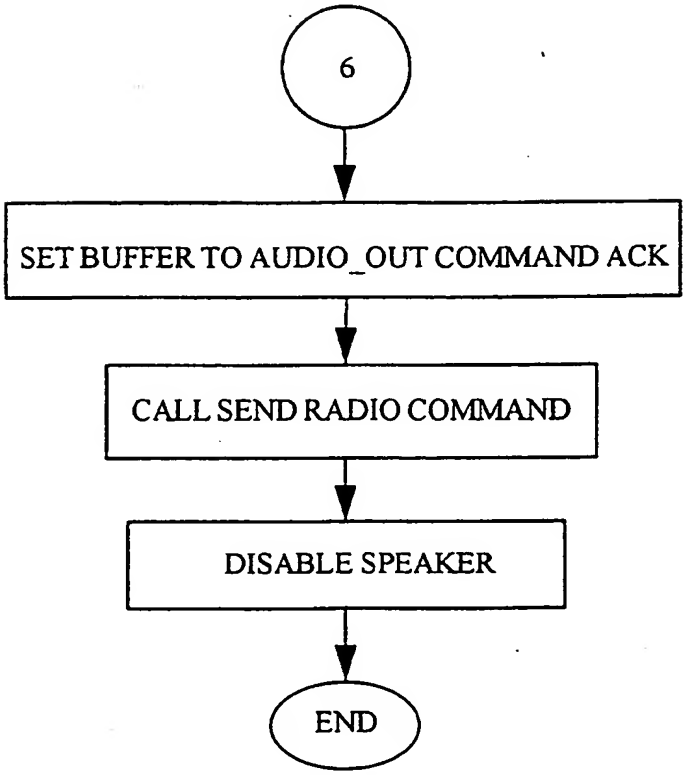
36 /150
FIGURE 8P



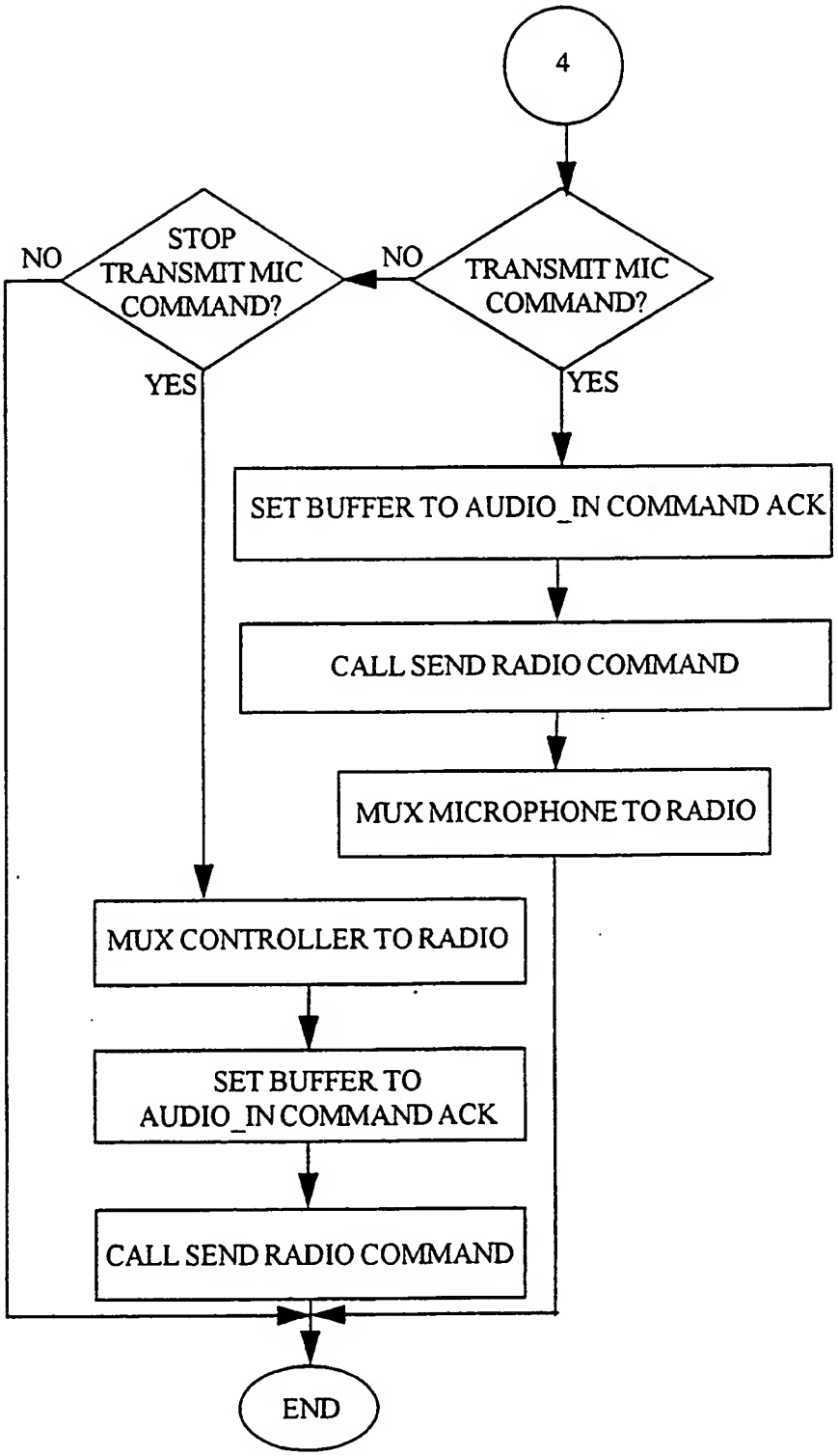
37 /150
FIGURE 8Q



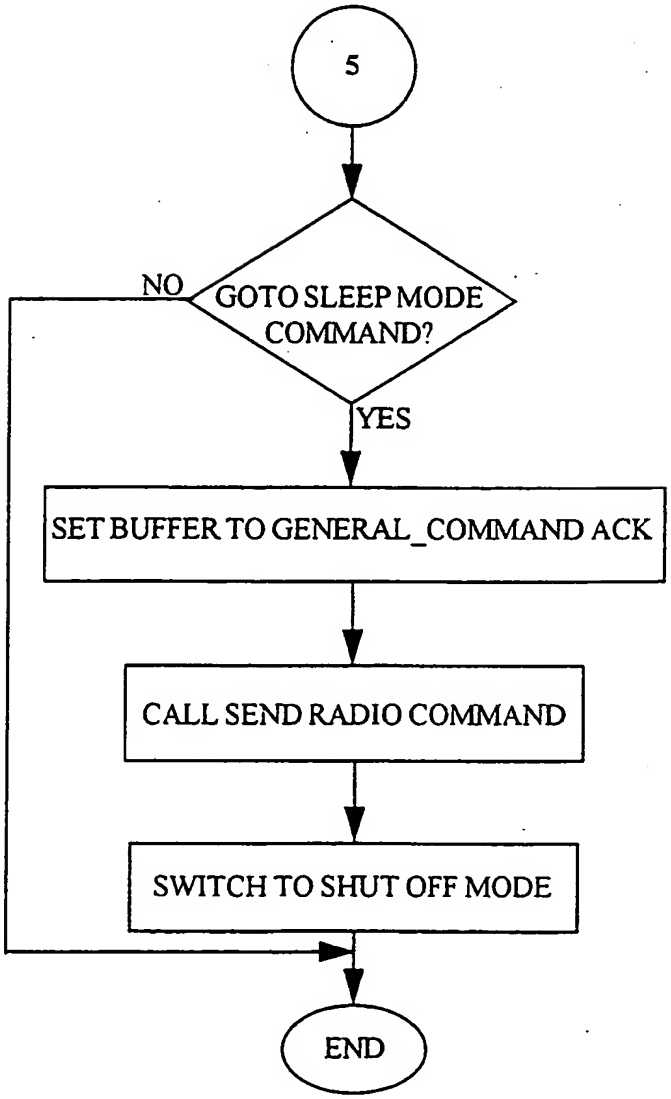
38 /150
FIGURE 8R



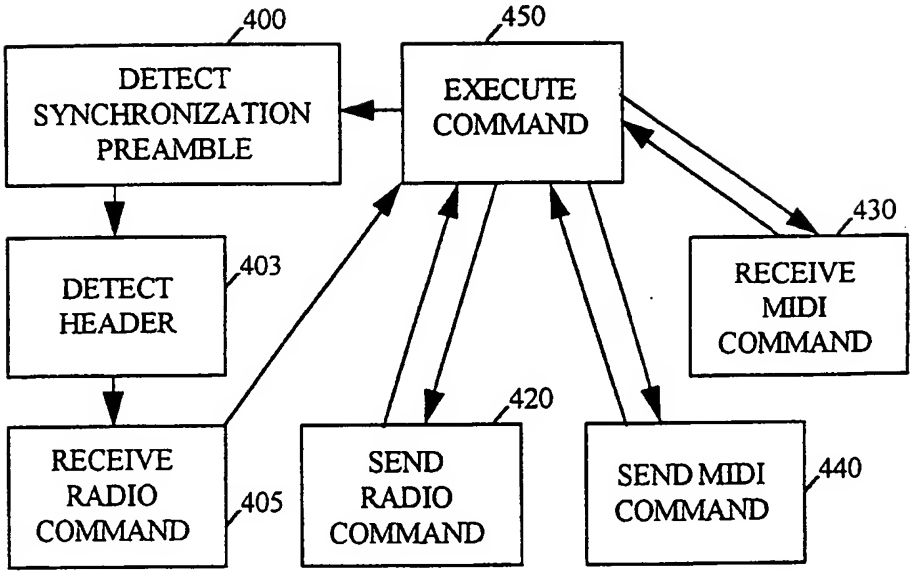
39 /150
FIGURE 8S



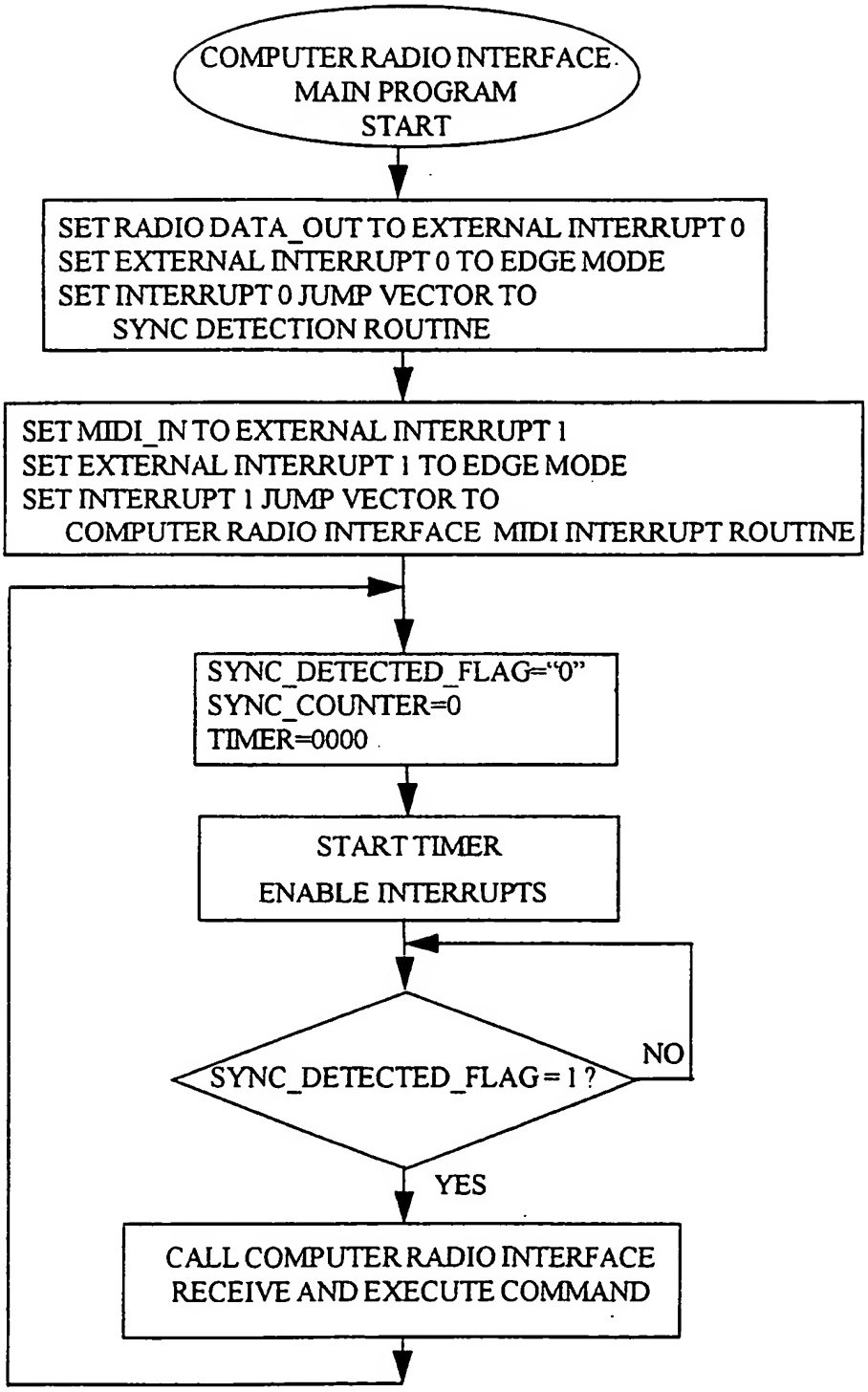
40 /150
FIGURE 8T



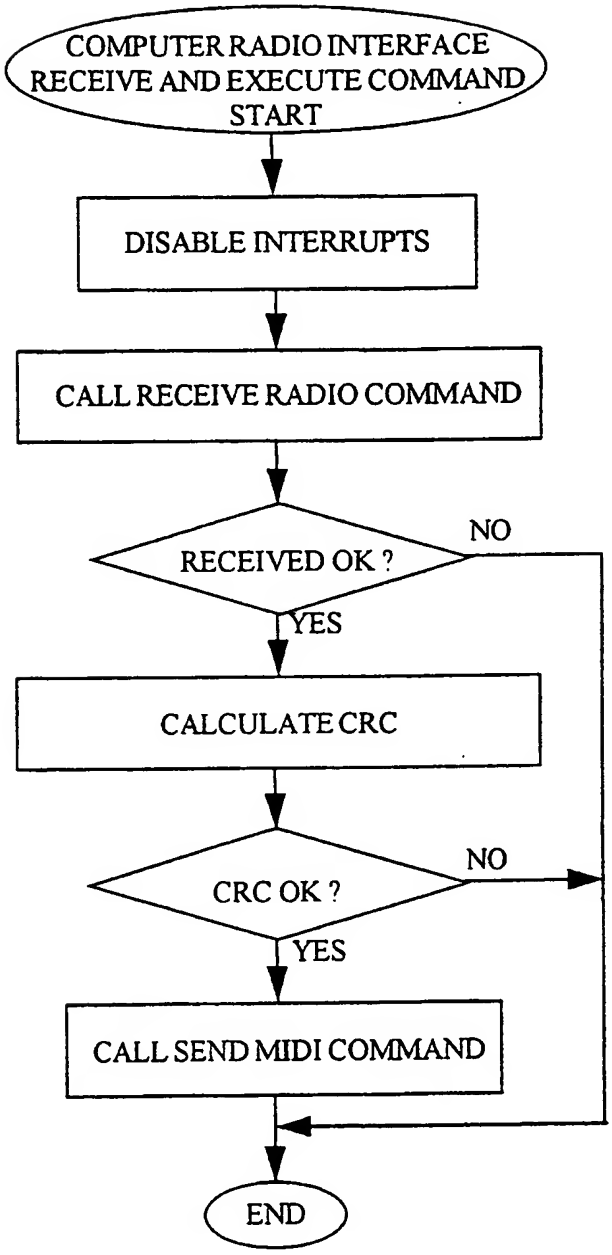
41 /150
FIGURE 9A



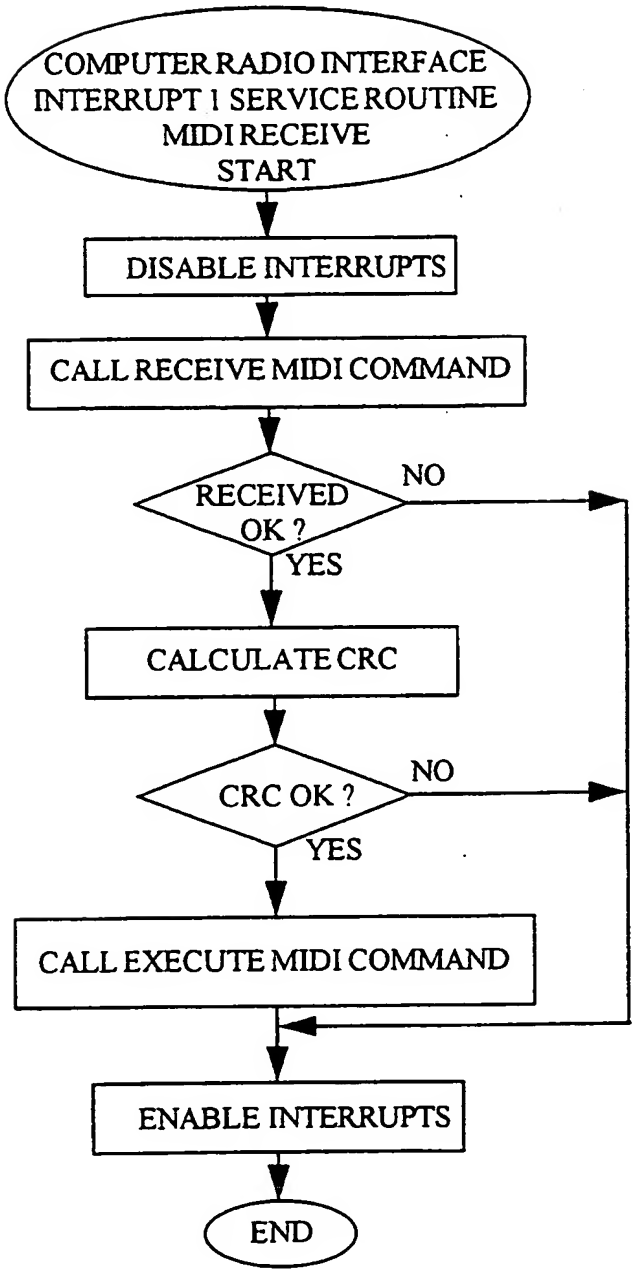
42 /150
FIGURE 9B



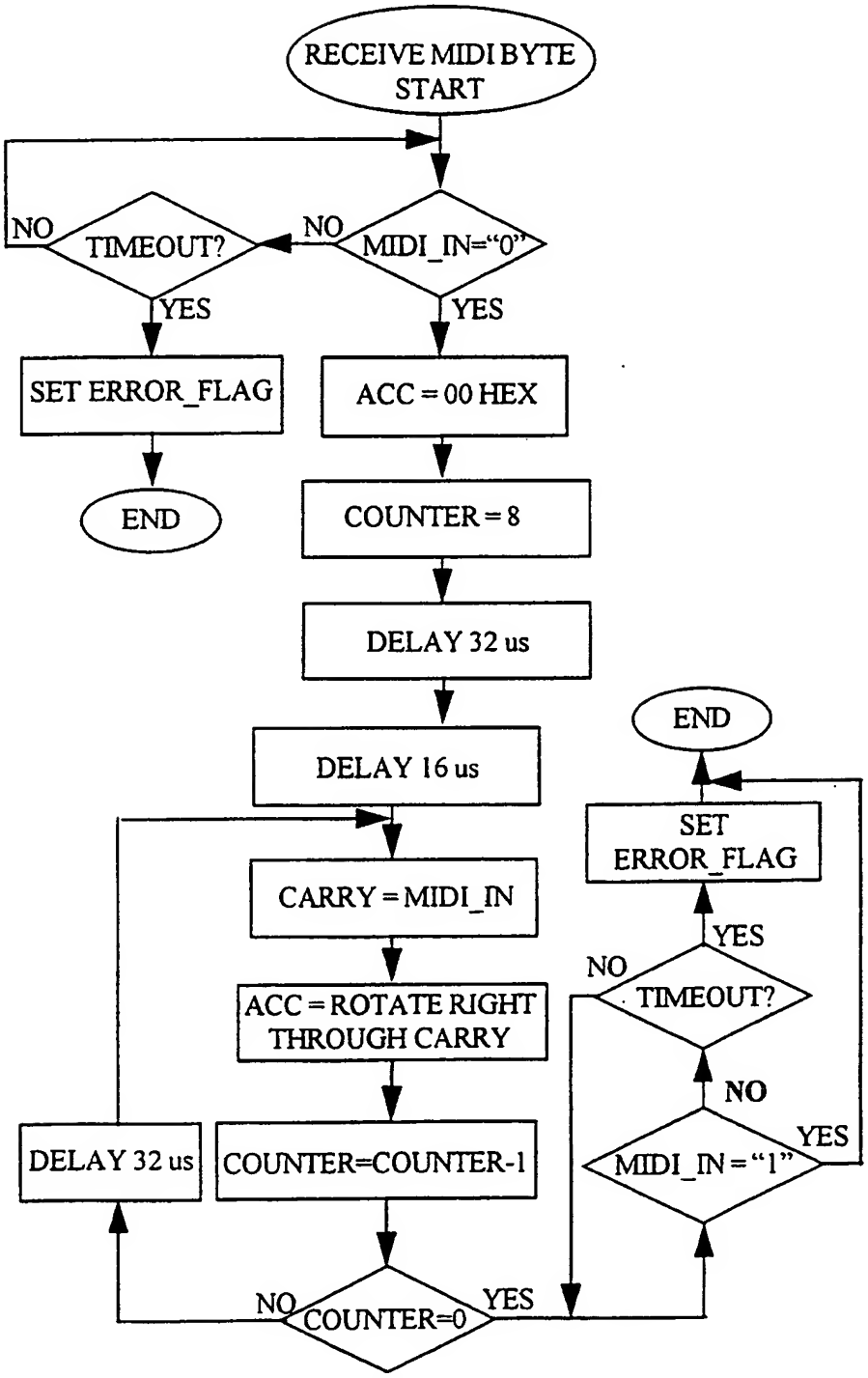
43 /150
FIGURE 9C



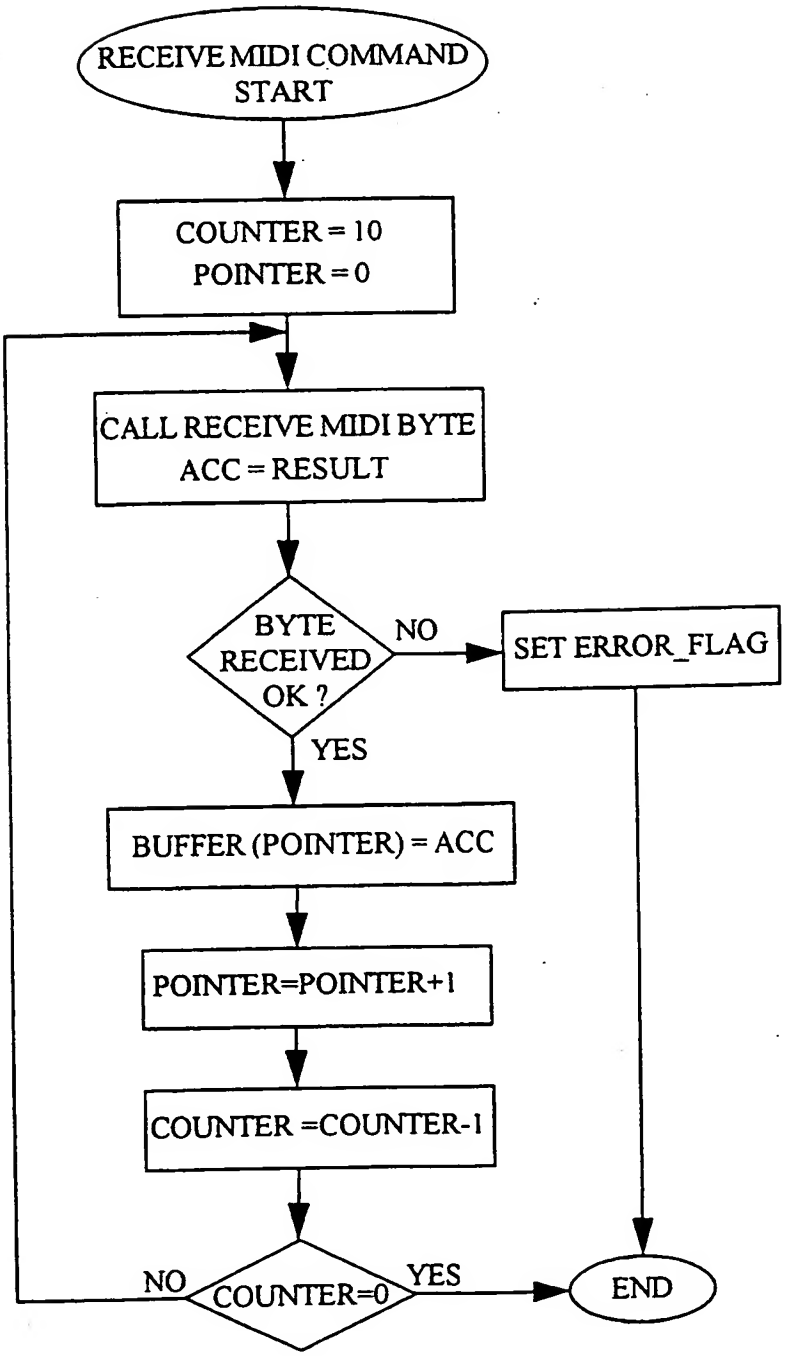
44 /150
FIGURE 9D



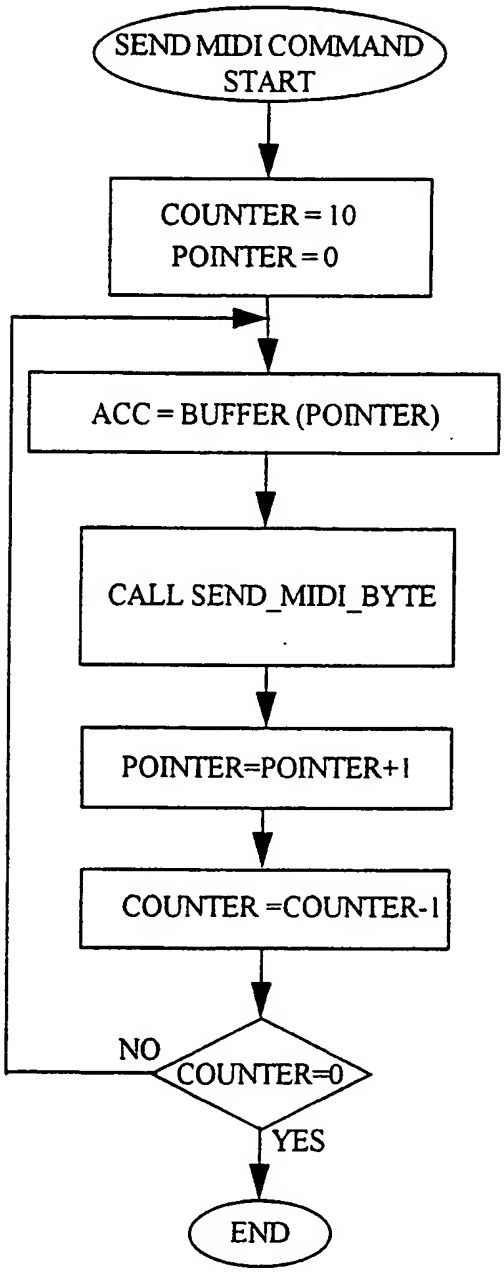
45 /150
FIGURE 9E



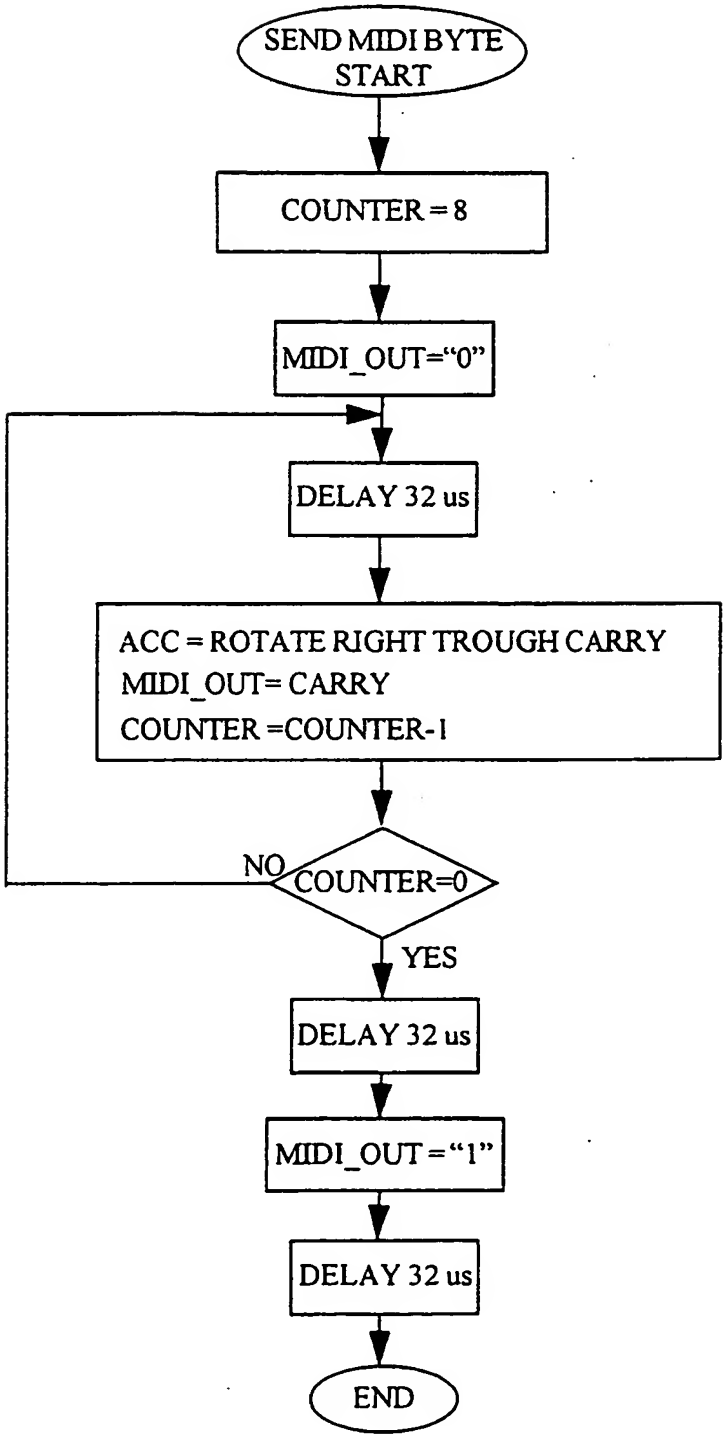
46 /150
FIGURE 9F



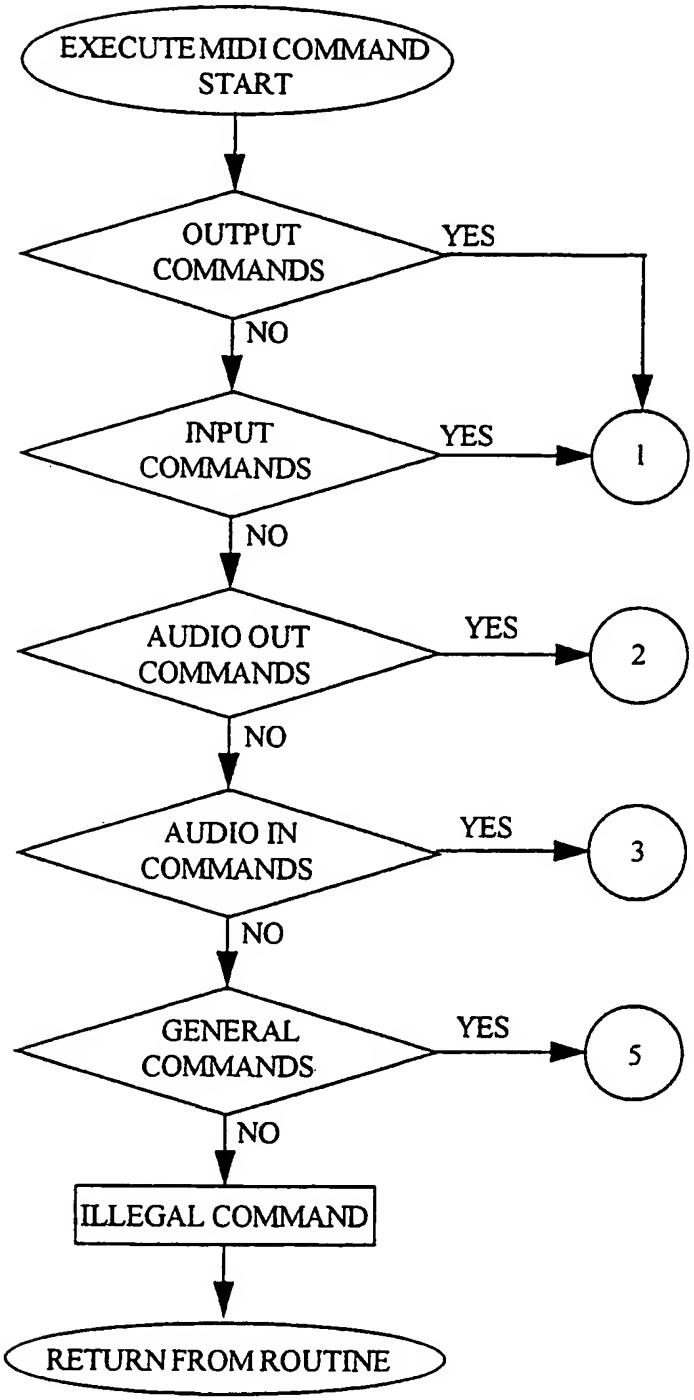
47 /150
FIGURE 9G



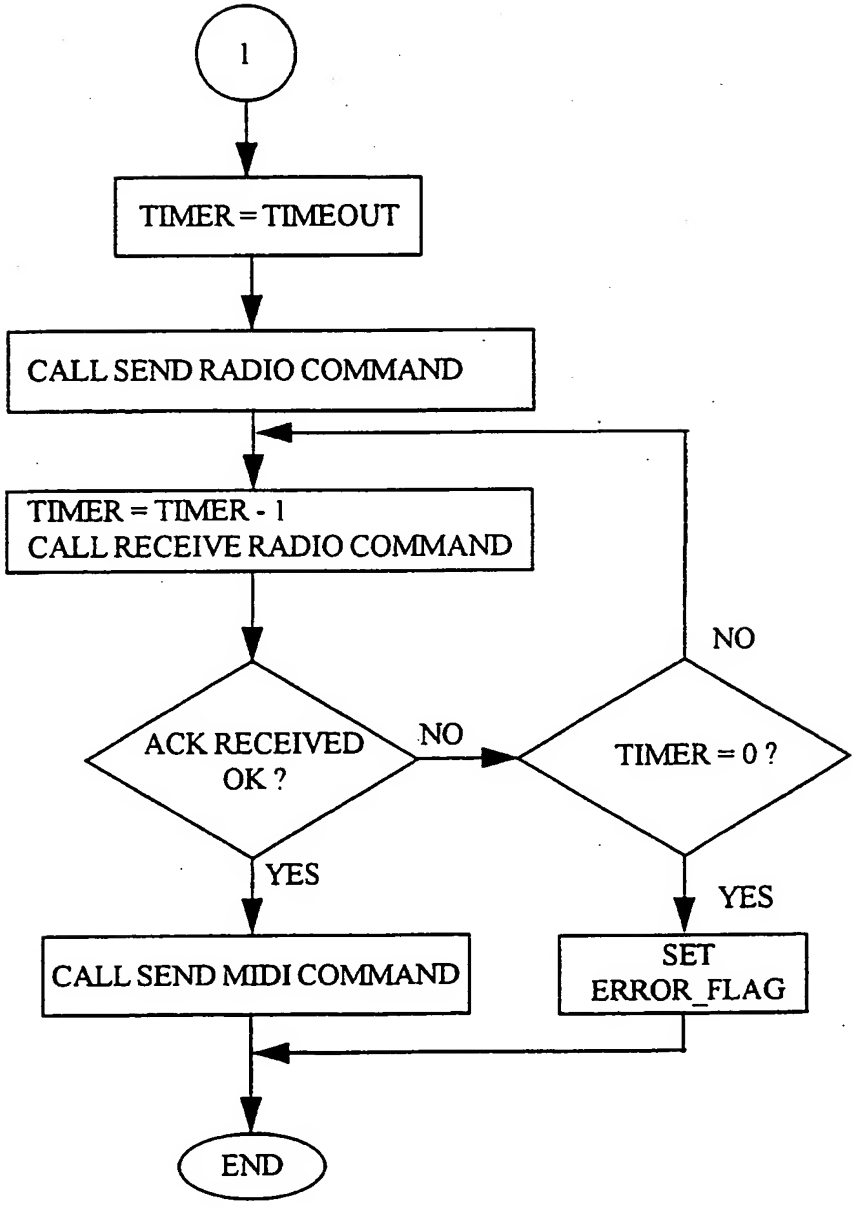
48 /150
FIGURE 9H



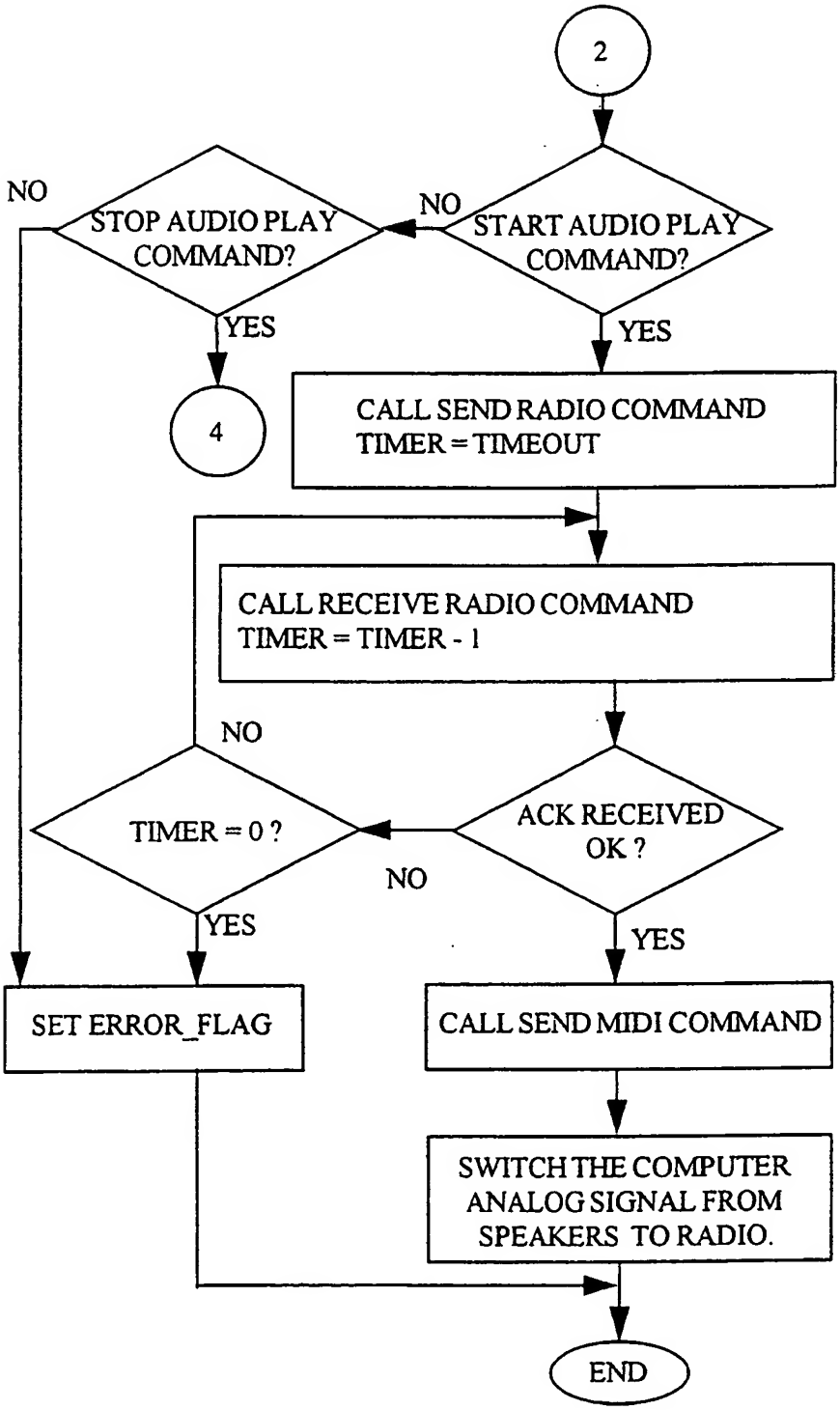
49 /150
FIGURE 9I



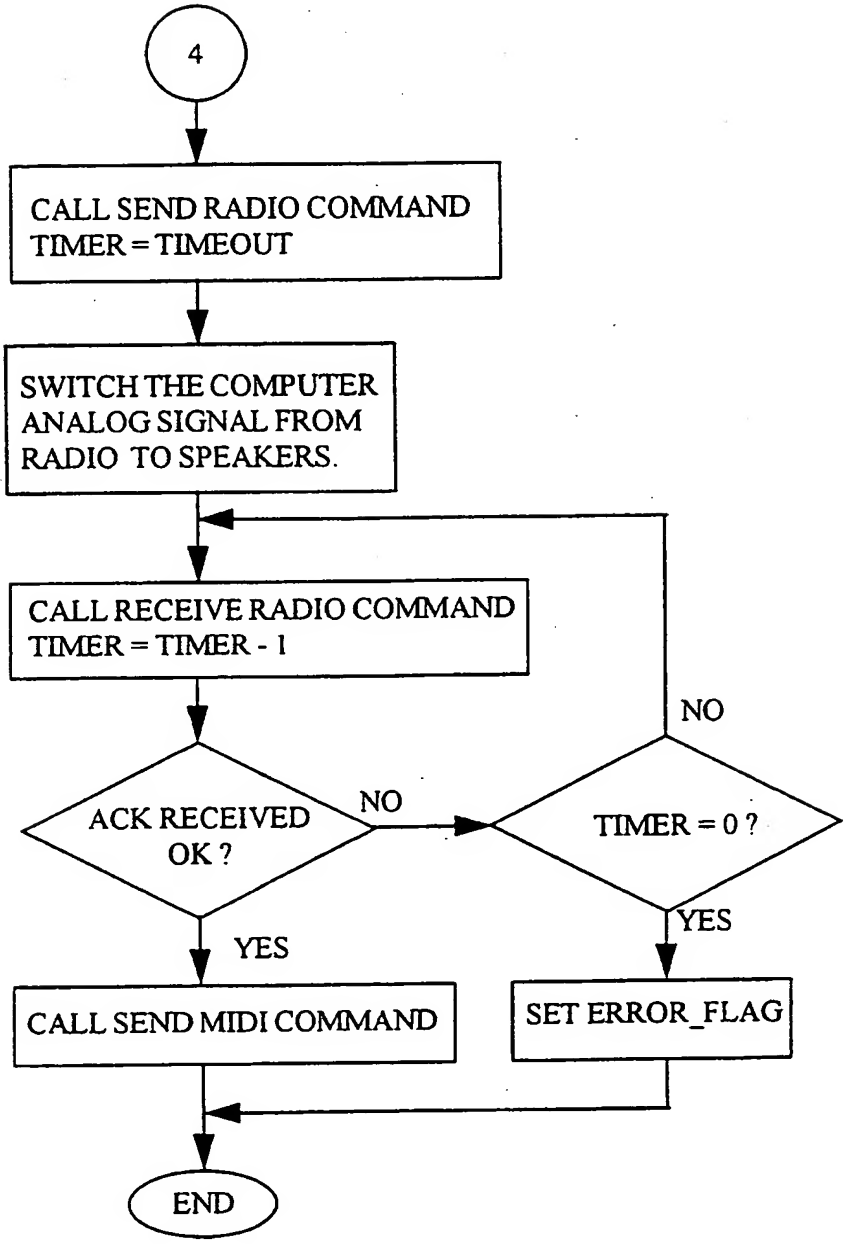
50 /150
FIGURE 9J



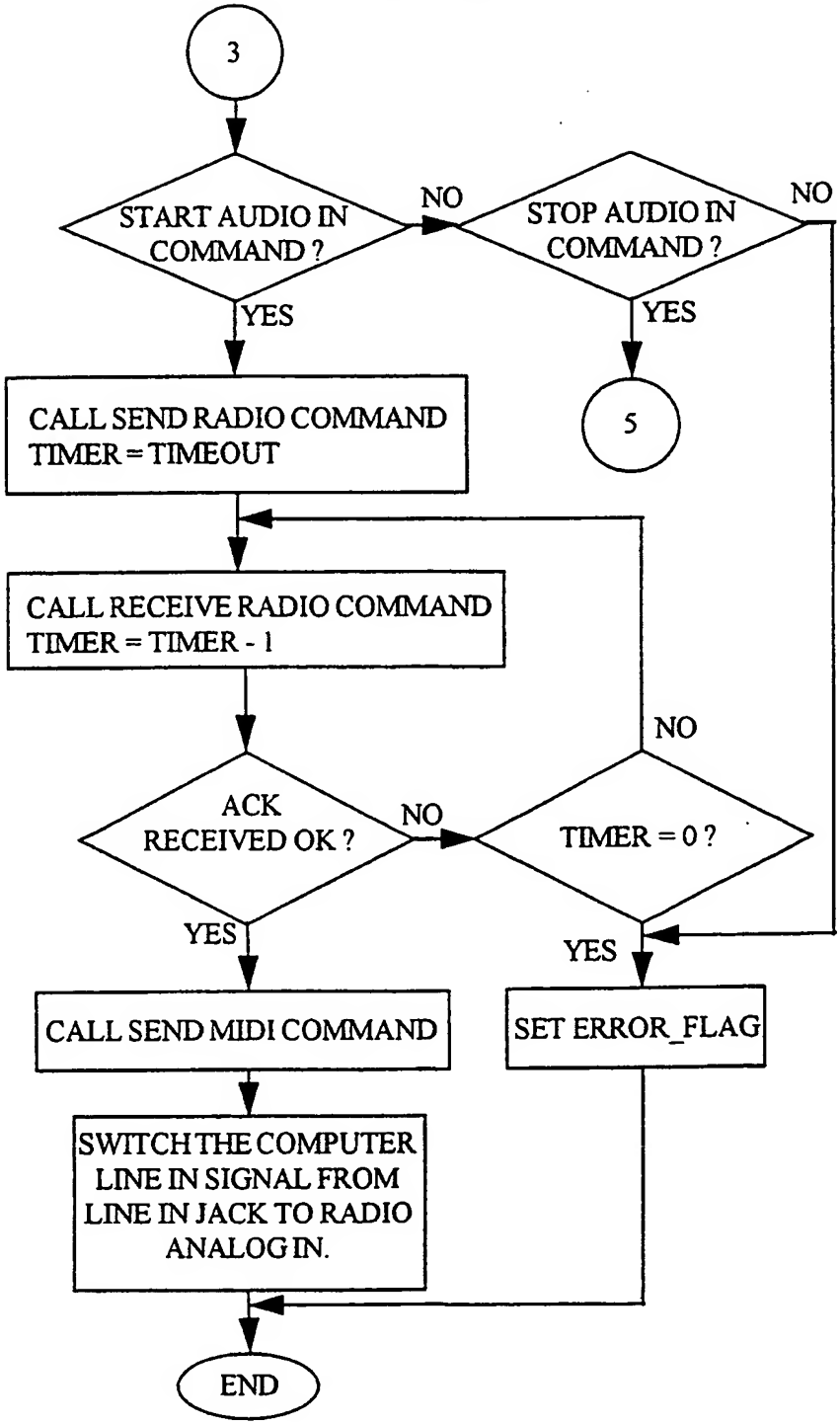
51 /150
FIGURE 9K



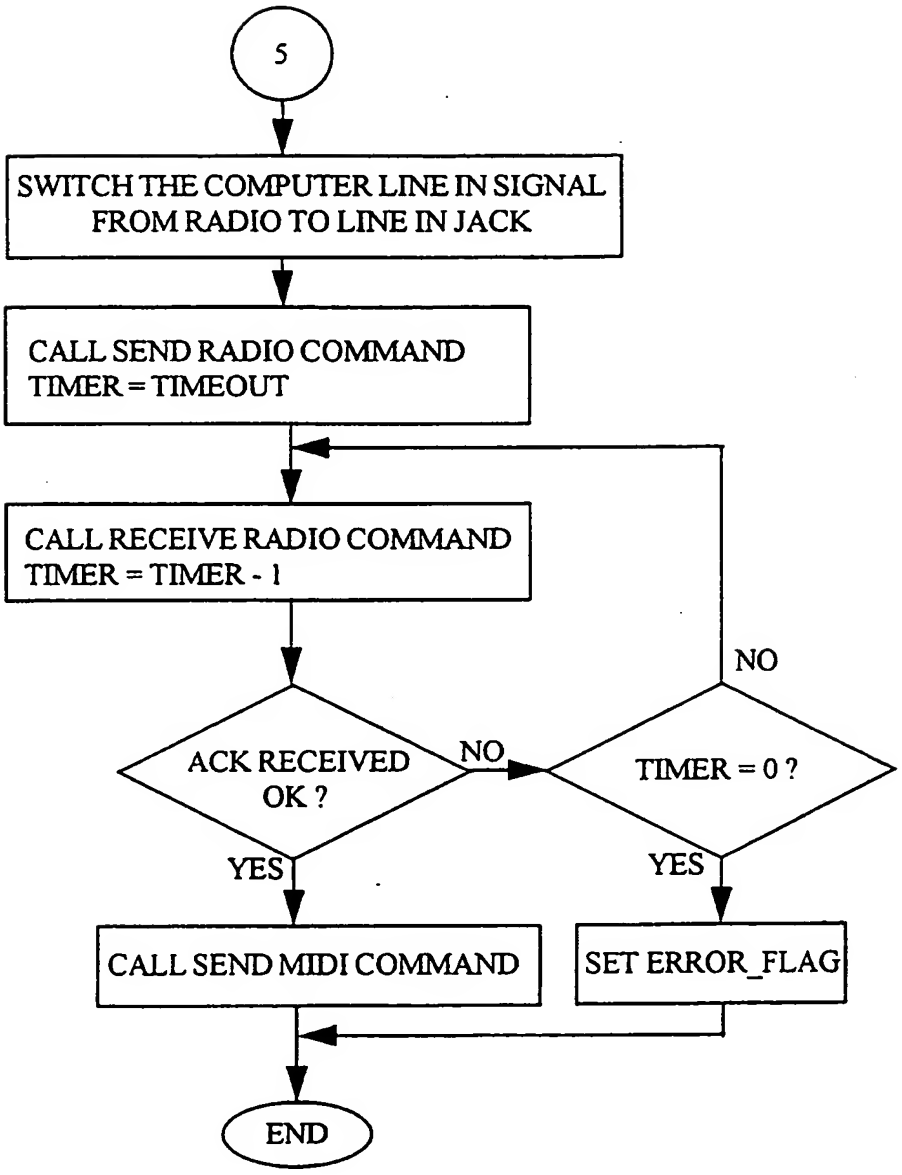
52 /150
FIGURE 9L



53 /150
FIGURE 9M



54 /150
FIGURE 9N



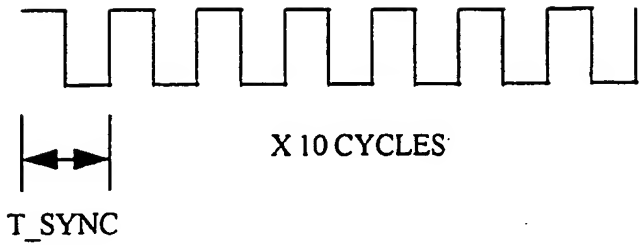


FIGURE 10A

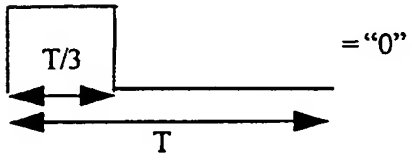


FIGURE 10B

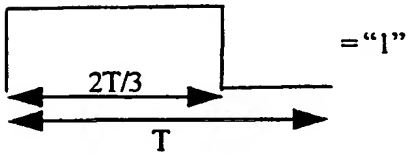
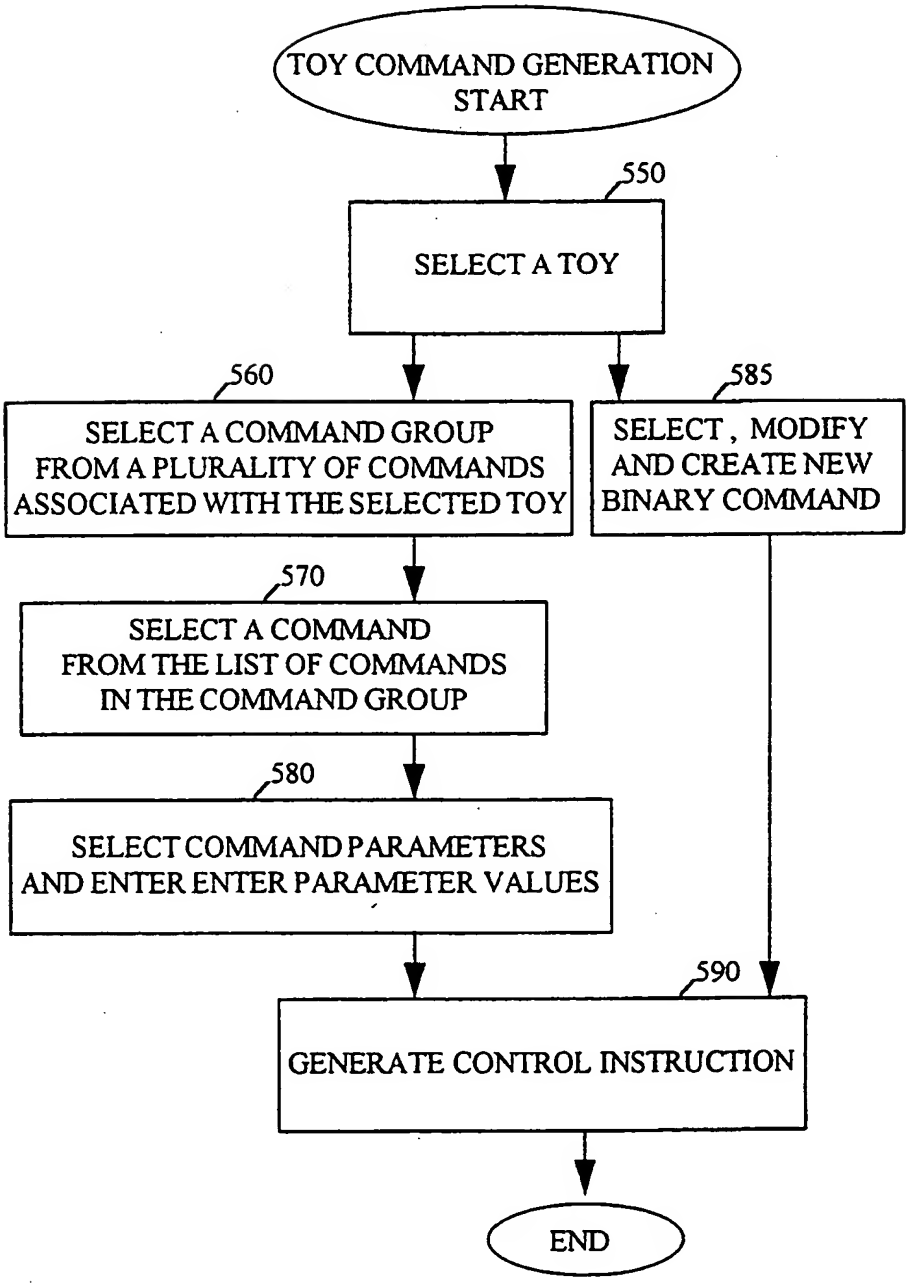
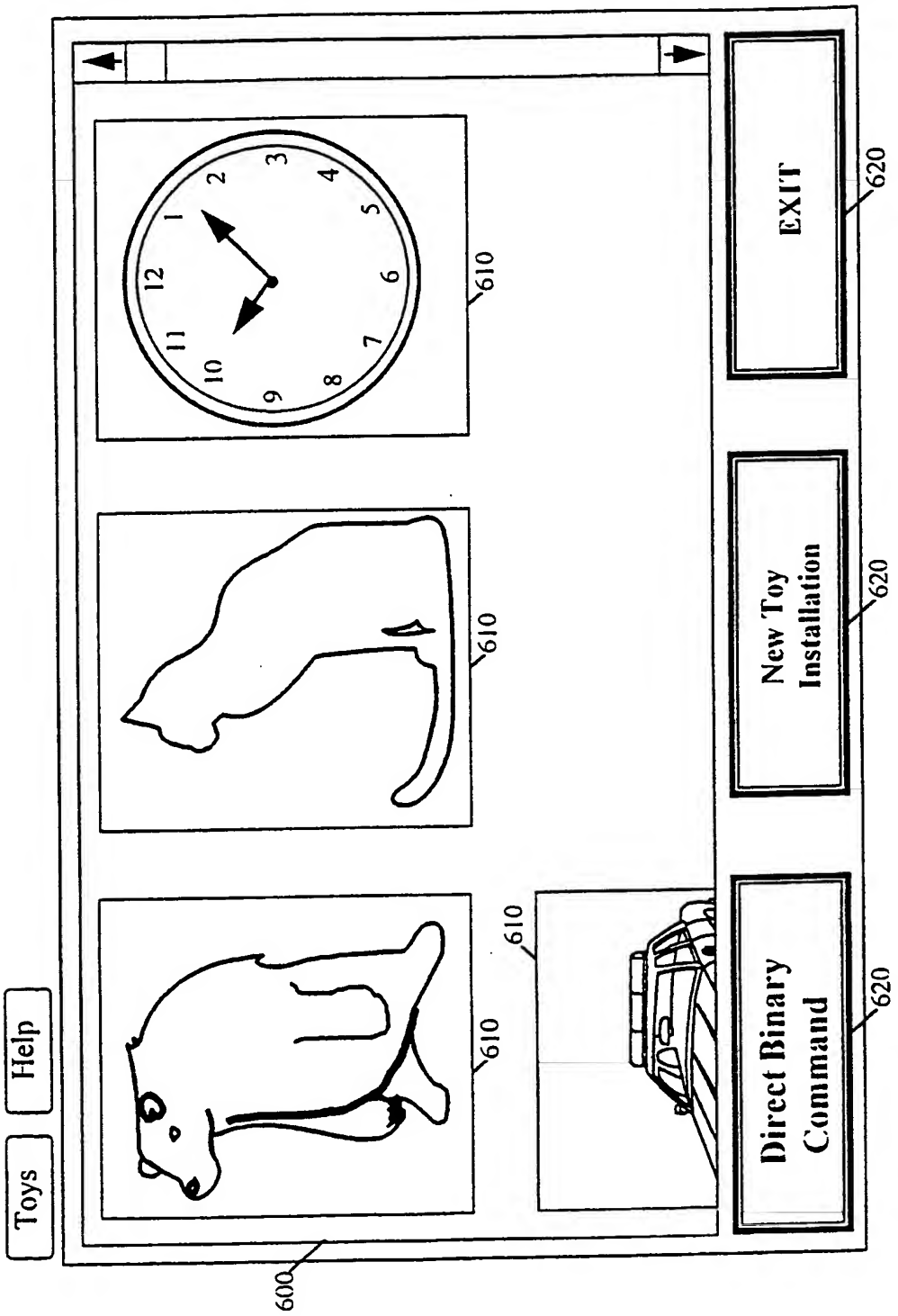


FIGURE 10C

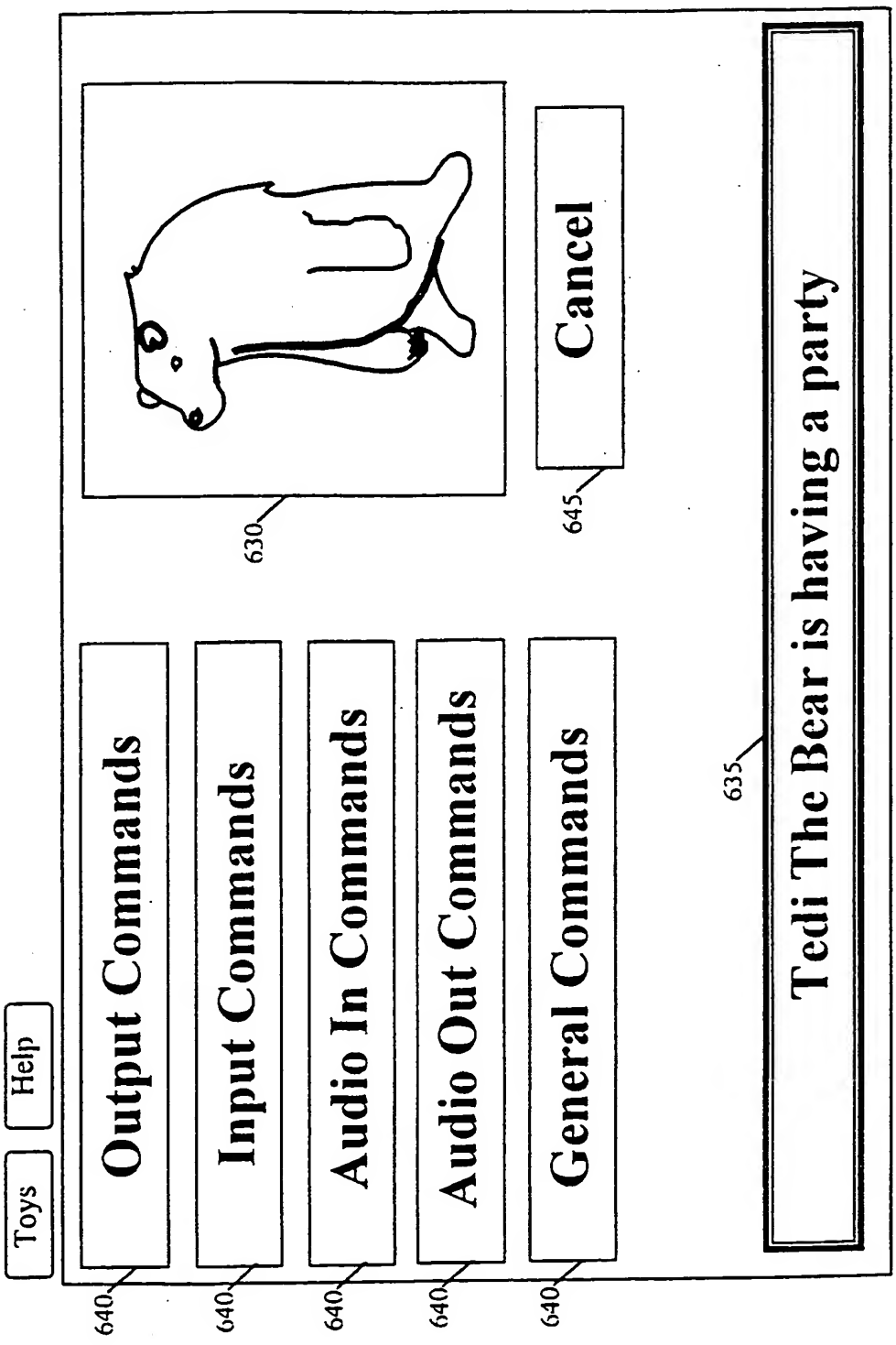
56 /150
FIGURE 11



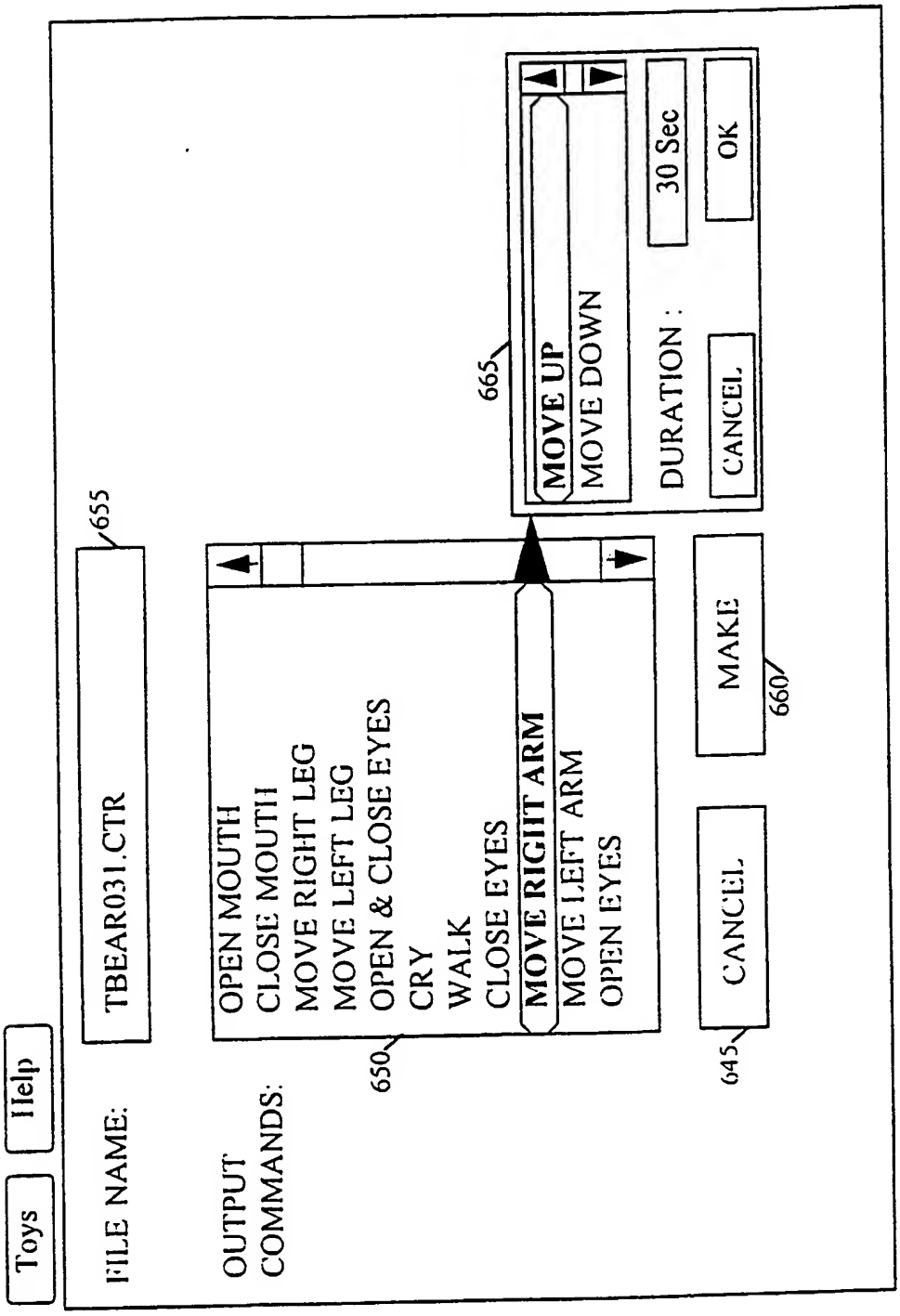
57 /150
FIGURE 12A



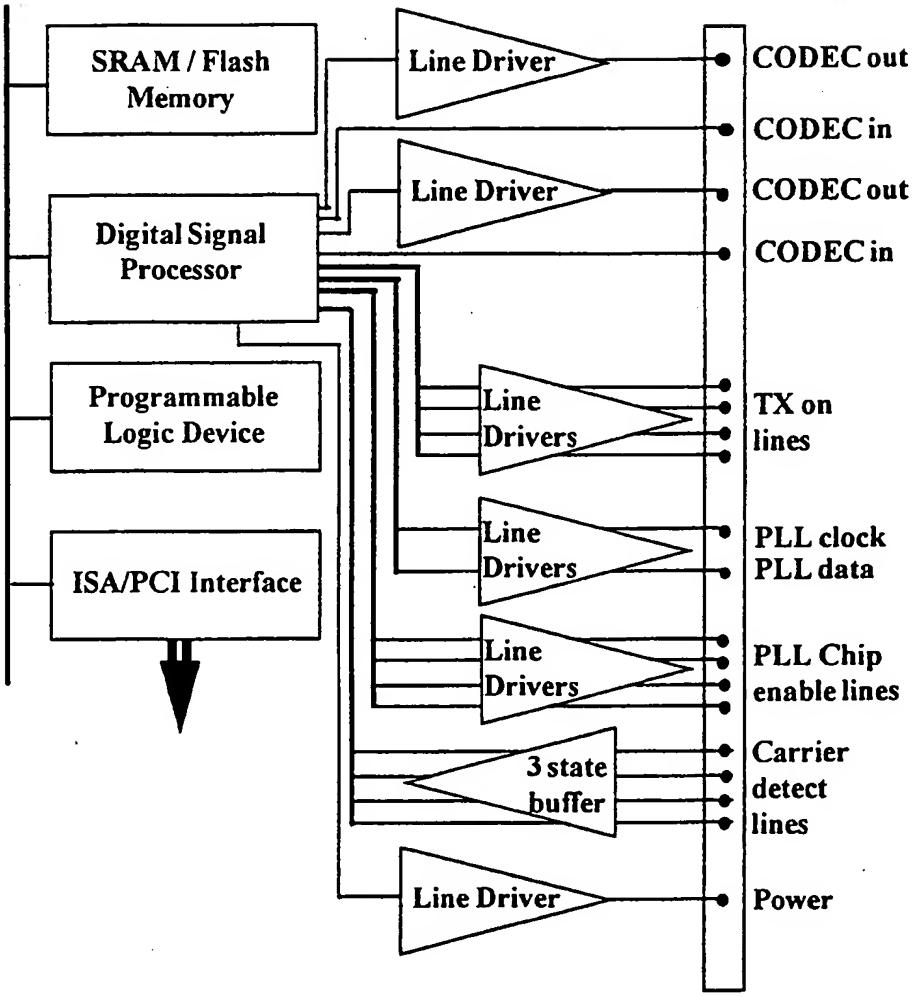
58 /150
FIGURE 12B



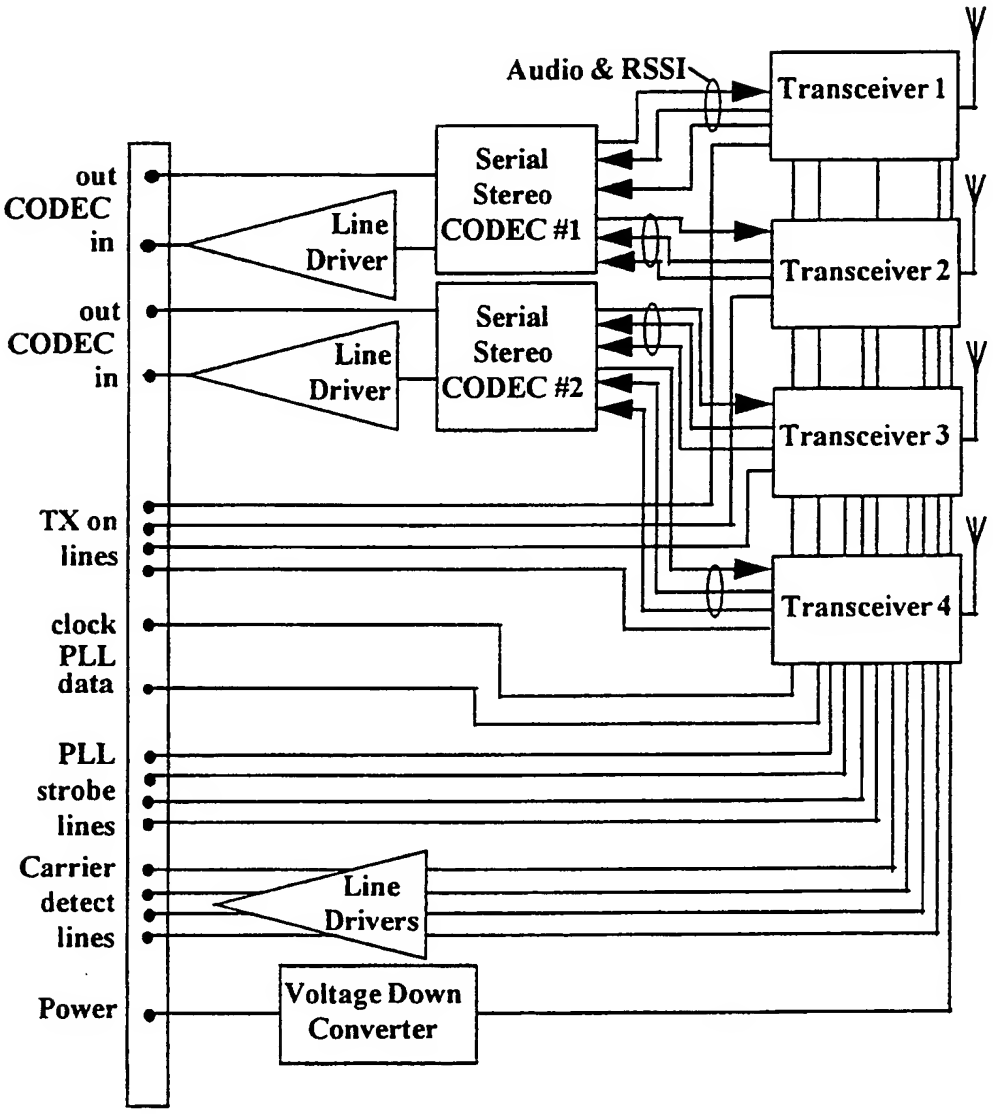
59 /150
FIGURE 12C



60 /150
FIGURE 13



61 /150
FIGURE 14



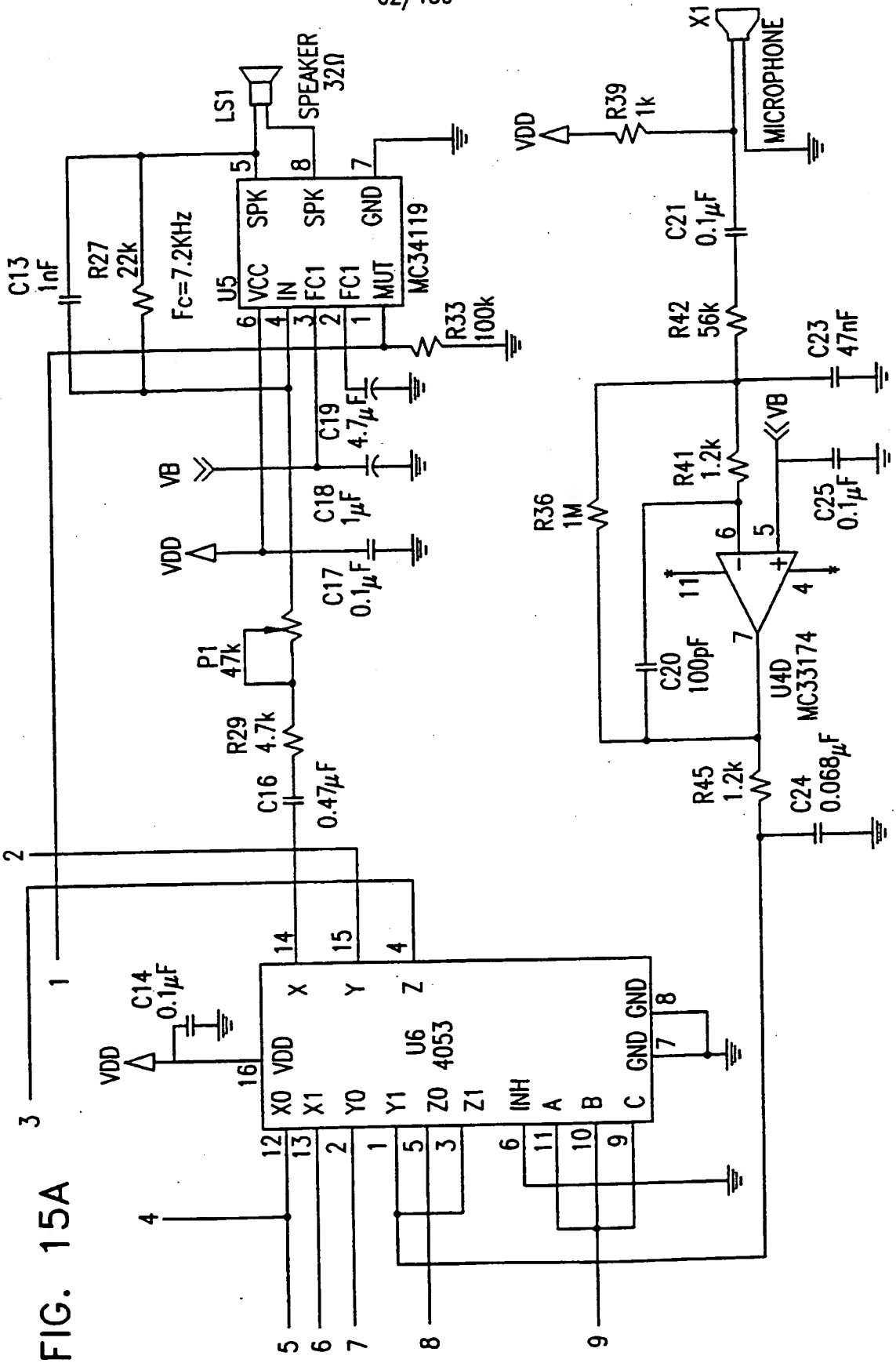

LS1
SPEAKER
32Ω
X1
MICROPHONE
VDD
R39
1k
C21
0.1μF
U5
MC34119
SPK
SPK
GND
VCC
IN
FC1
FC1
MUT
C13
1nF
R27
22k
Fc=7.2KHz
R33
100k
R42
56k
C23
47nF
C19
4.7μF
VB
C18
1μF
C17
0.1μF
R41
1.2k
C25
0.1μF
R36
1M
C20
100pF
U4D
MC33174
P1
47k
R29
4.7k
C16
0.47μF
R45
1.2k
C24
0.068μF
C14
0.1μF
U6
4053
VDD
X
Y
Z
GND
X0
X1
Y0
Y1
Z0
Z1
INH
A
B
C
1
2
3
4
5
6
7
8
9

FIG. 15A

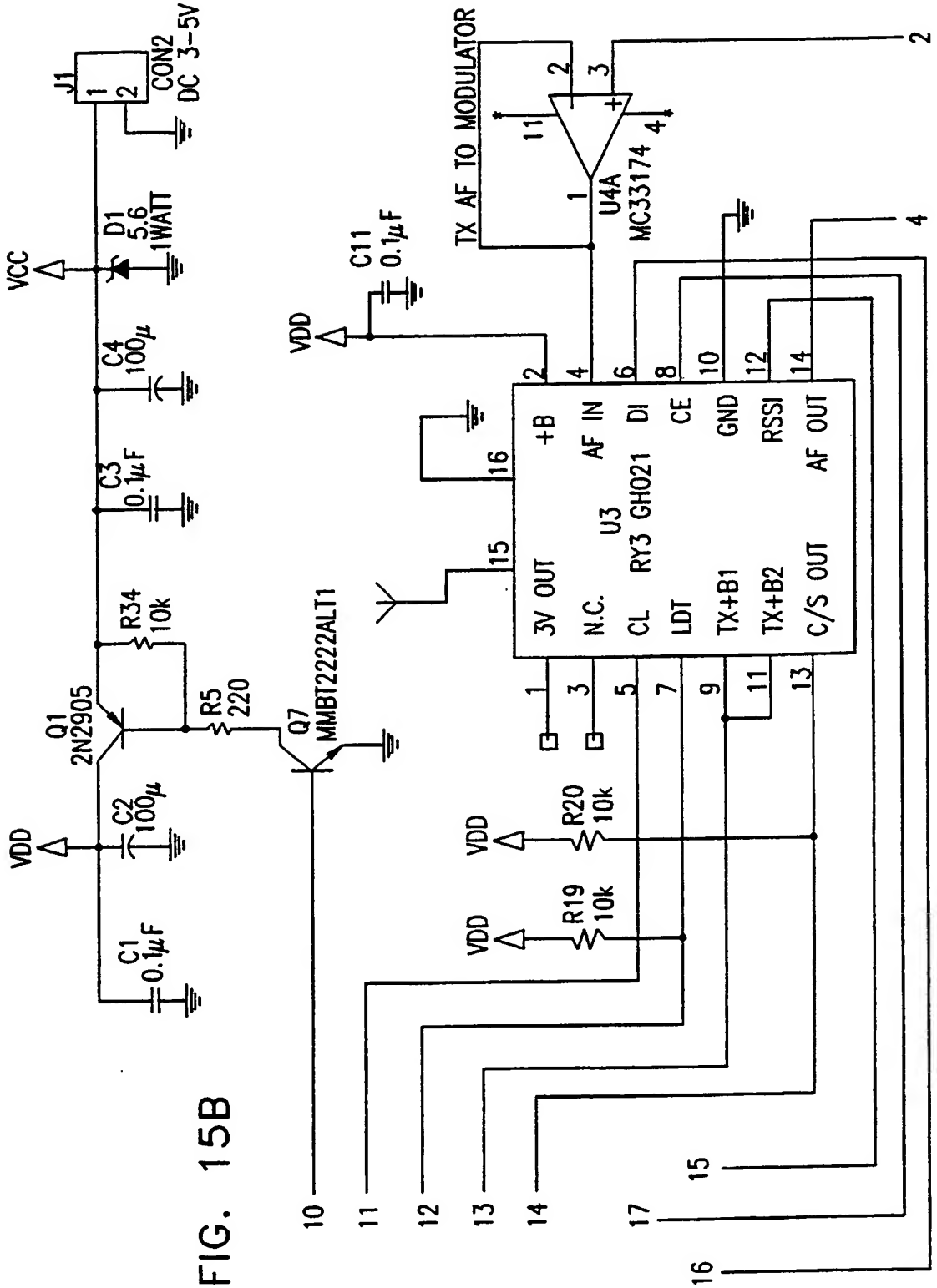

J1
CON2
DC 3-5V
VCC
D1
5.6
1WATT
C4
100µ
C3
0.1µF
R34
10k
Q1
2N2905
R5
220
Q7
MMBT2222ALT1
C2
100µ
C1
0.1µF
VDD
C11
0.1µF
TX AF TO MODULATOR
U4A
MC33174
U3
RY3 GH021
+B
AF IN
DI
CE
GND
RSSI
AF OUT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
R20
10k
R19
10k

FIG. 15B

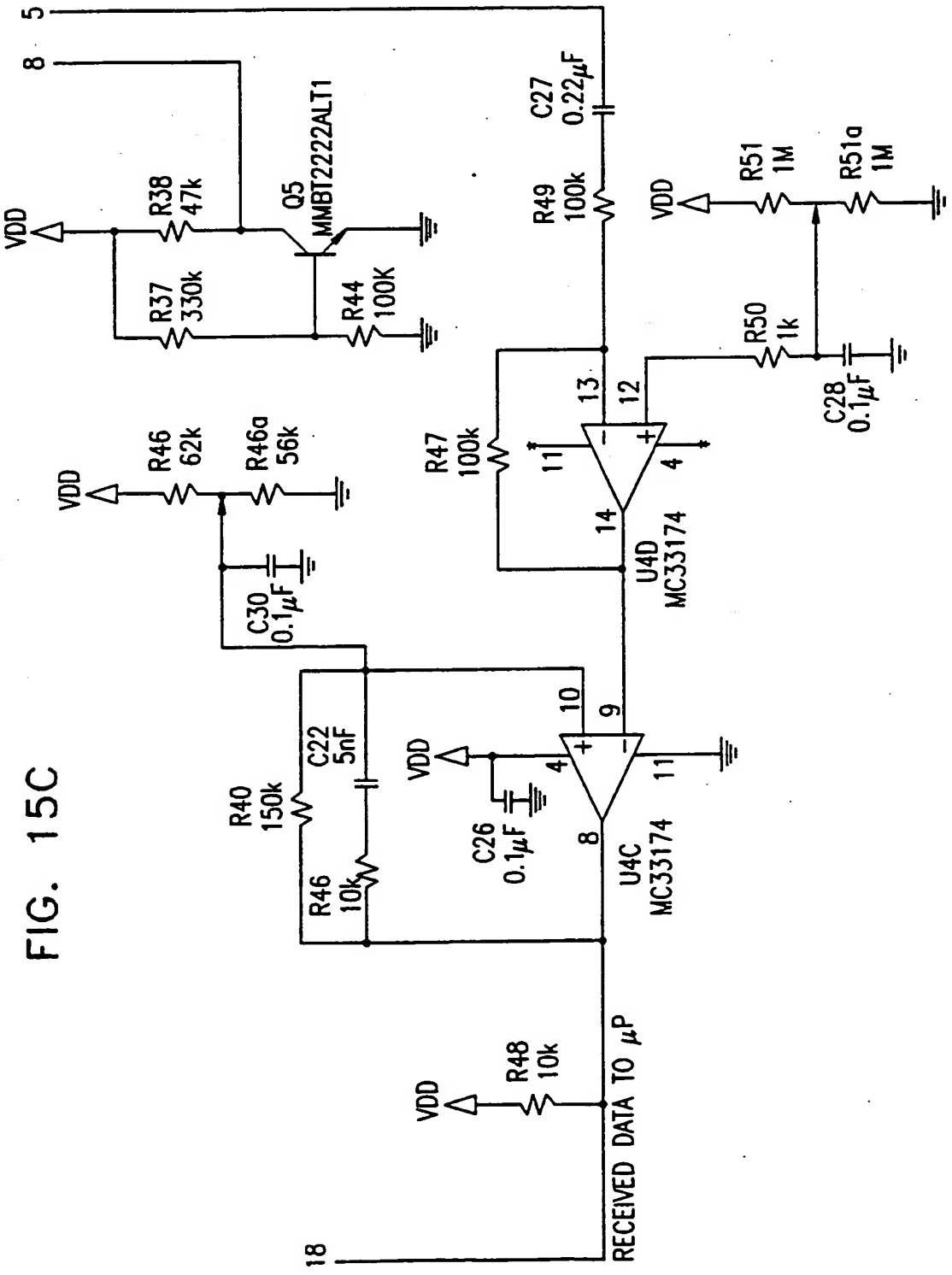
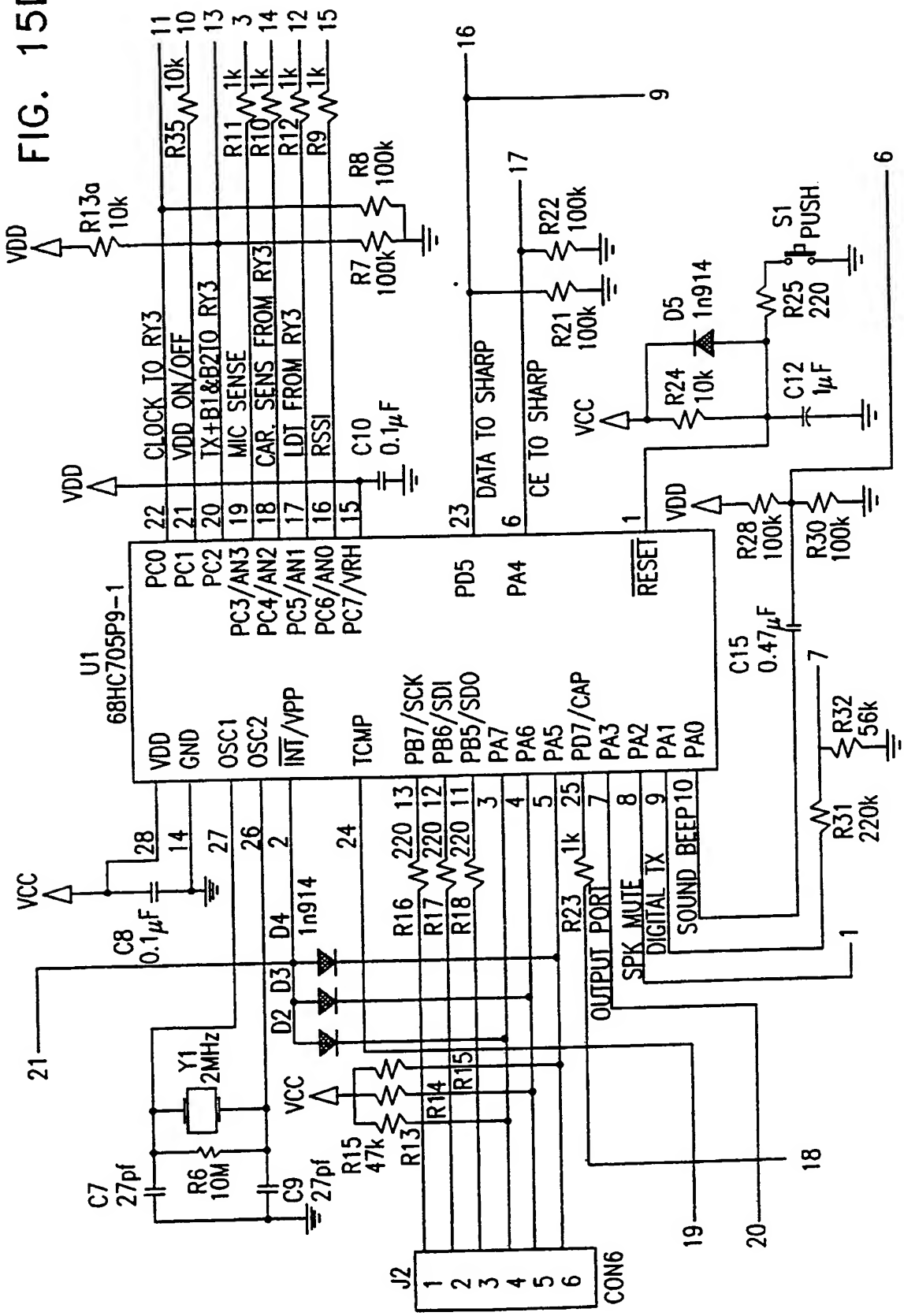

5
8
VDD
R38 47k
Q5 MMBT2222ALT1
R37 330k
R44 100K
C27 0.22µF
R49 100k
VDD
R51 1M
R51a 1M
R50 1k
C28 0.1µF
R47 100k
13
12
11
14
4
U4D MC33174
VDD
R46 62k
R46a 56k
C30 0.1µF
C22 5nF
R40 150k
R46 10k
10
9
VDD
4
8
11
C26 0.1µF
U4C MC33174
VDD
R48 10k
18
RECEIVED DATA TO µP

FIG. 15C

FIG. 15D


U1
68HC705P9-1
PC0
PC1
PC2
PC3/AN3
PC4/AN2
PC5/AN1
PC6/AN0
PC7/VRH
PD5
PA4
RESET
VDD
GND
OSC1
OSC2
INT/VPP
TCMP
PB7/SCK
PB6/SDI
PB5/SDO
PA7
PA6
PA5
PD7/CAP
PA3
PA2
PA1
PA0
CLOCK TO RY3
VDD ON/OFF
TX+B1&B2TO RY3
MIC SENSE
CAR. SENS FROM RY3
LDT FROM RY3
RSSI
DATA TO SHARP
CE TO SHARP
OUTPUT PORT
SPK MUTE
DIGITAL TX
SOUND BEEP
R13a 10k
R35 10k
R11 1k
R10 1k
R12 1k
R9 1k
R8 100k
R7 100k
R22 100k
R21 100k
R24 10k
D5 1n914
R25 220
S1 PUSH
C12 1µF
C10 0.1µF
R28 100k
R30 100k
C15 0.47µF
R32 56k
R31 220k
R16 220
R17 220
R18 220
R23 1k
D4 1n914
D3
D2
C8 0.1µF
Y1 2MHz
C7 27pf
C9 27pf
R6 10M
R15 47k
R14
R13
J2
CON6
VDD
VCC

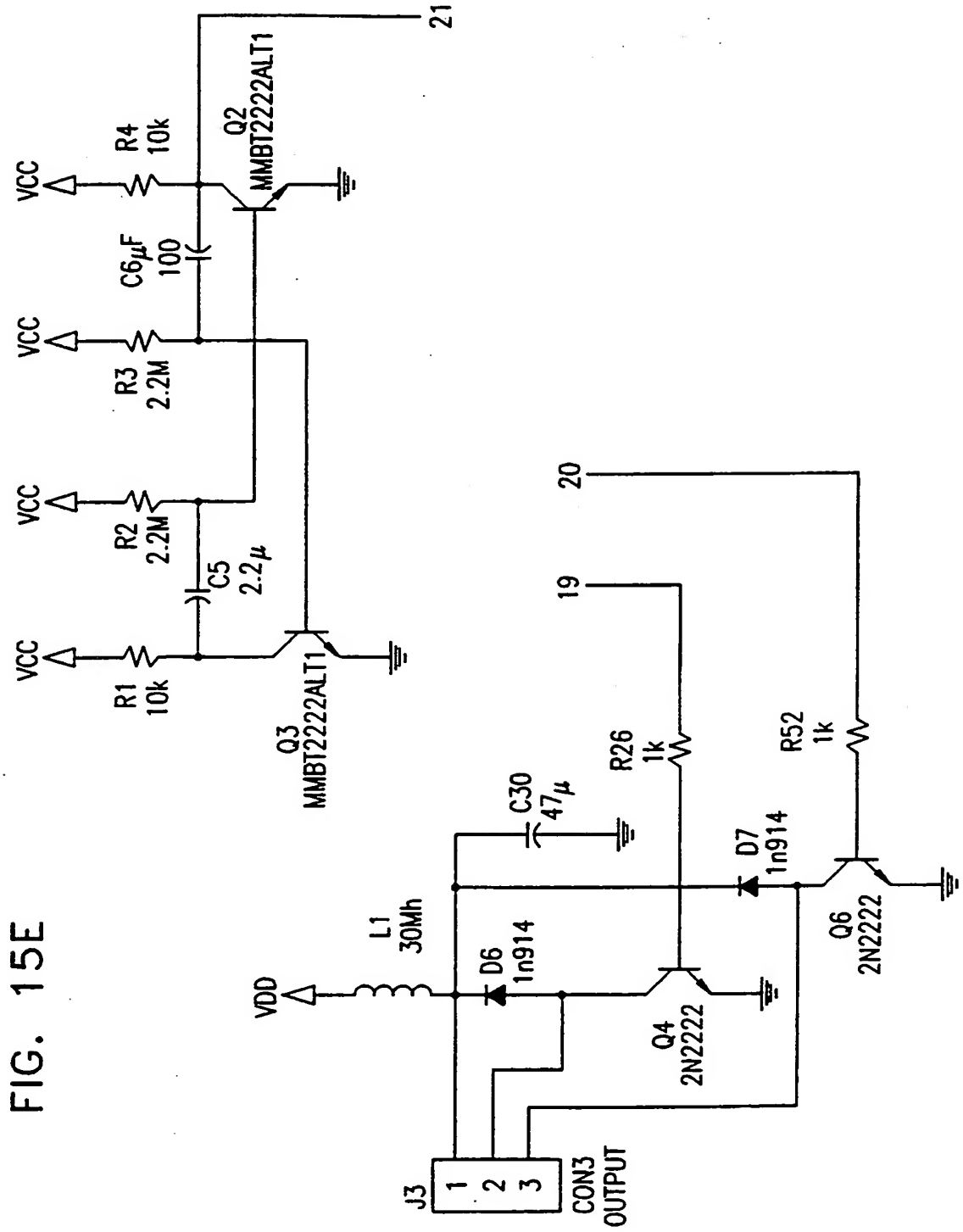
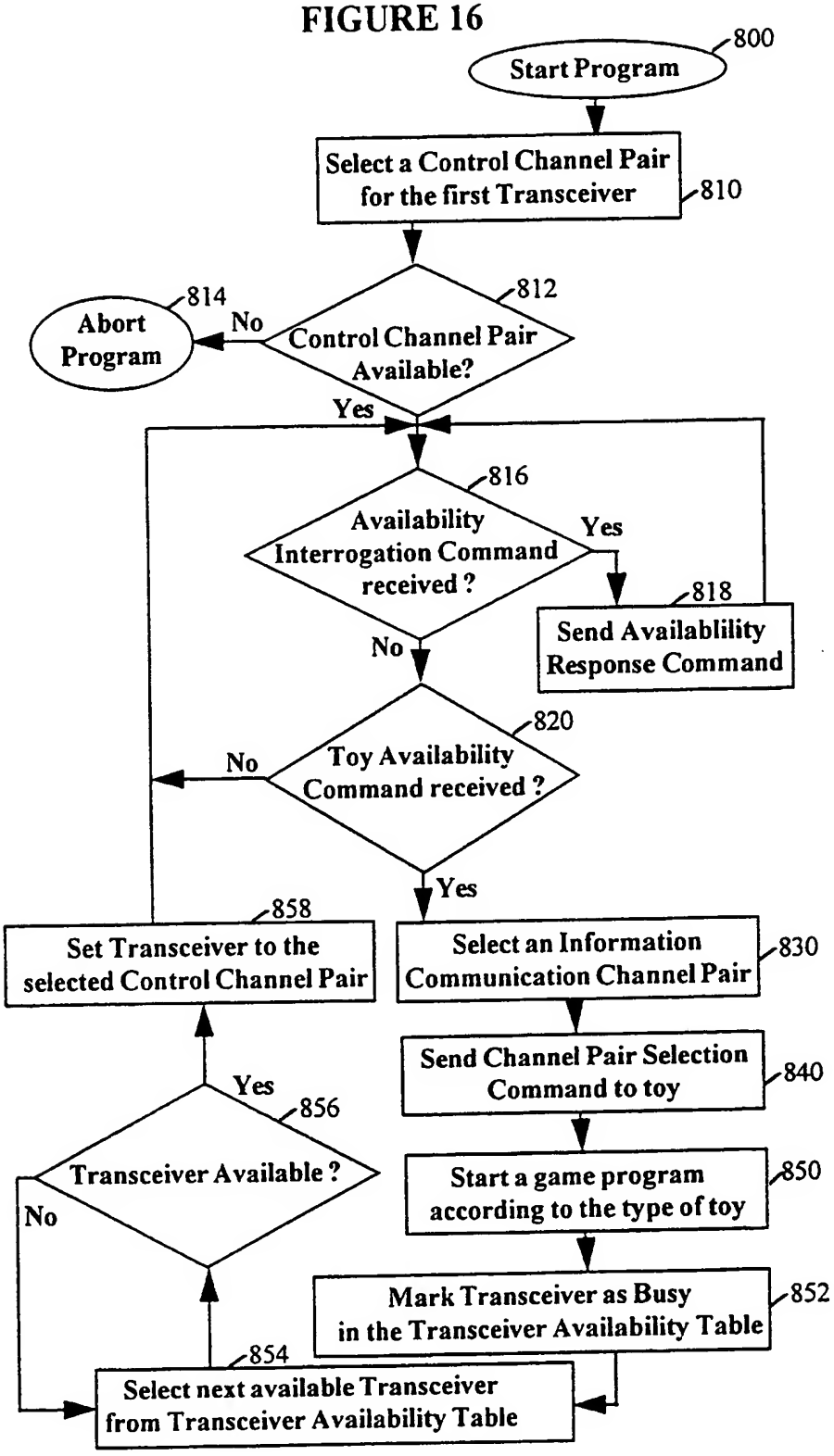
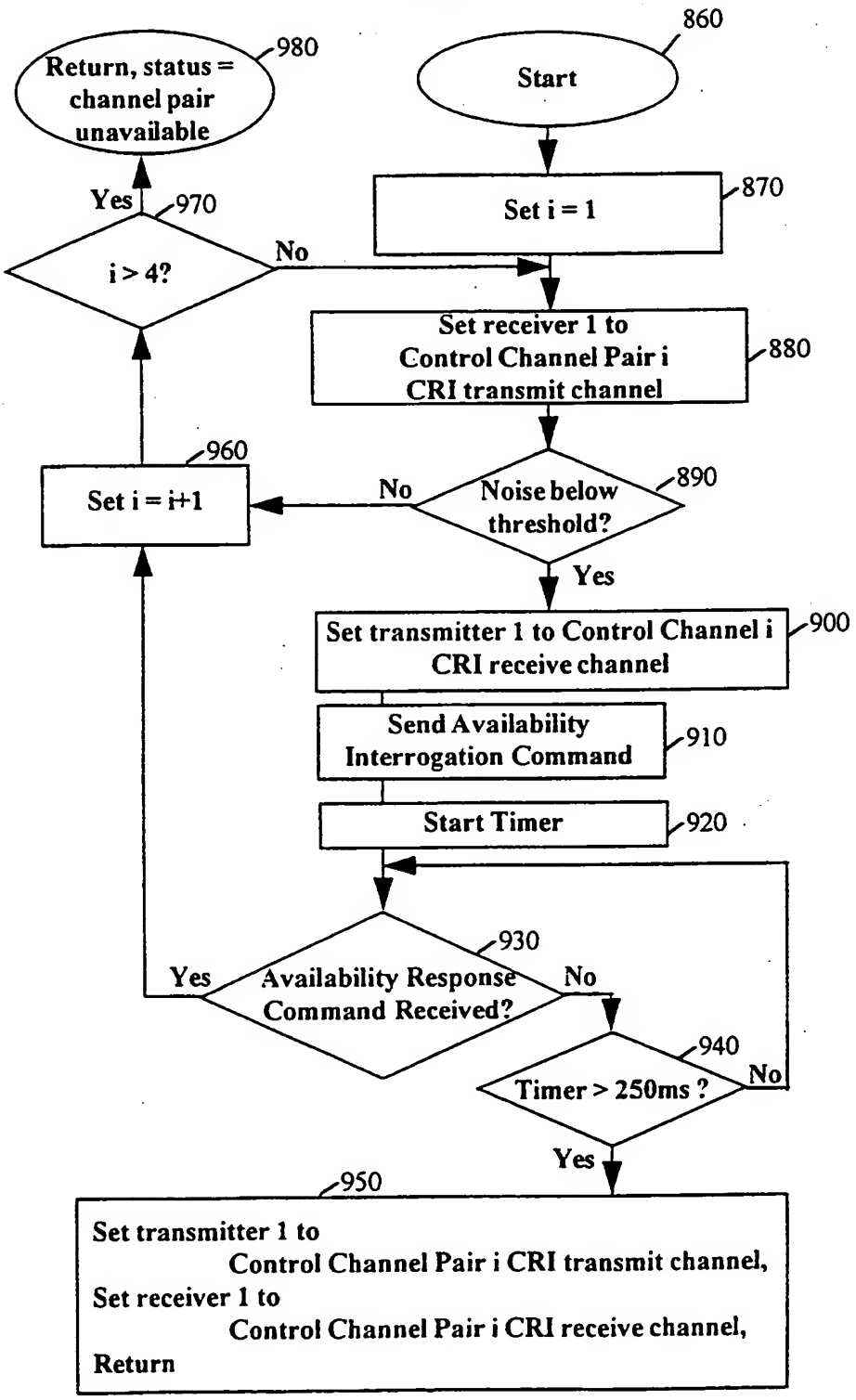

21
Q2
MMBT2222ALT1
R4
10k
VCC
C6µF
100
VCC
R3
2.2M
VCC
R2
2.2M
C5
2.2µ
VCC
R1
10k
Q3
MMBT2222ALT1
20
19
R26
1k
R52
1k
C30
47µ
D7
1n914
Q6
2N2222
L1
30Mh
VDD
D6
1n914
Q4
2N2222
J3
1
2
3
CON3
OUTPUT

FIG. 15E

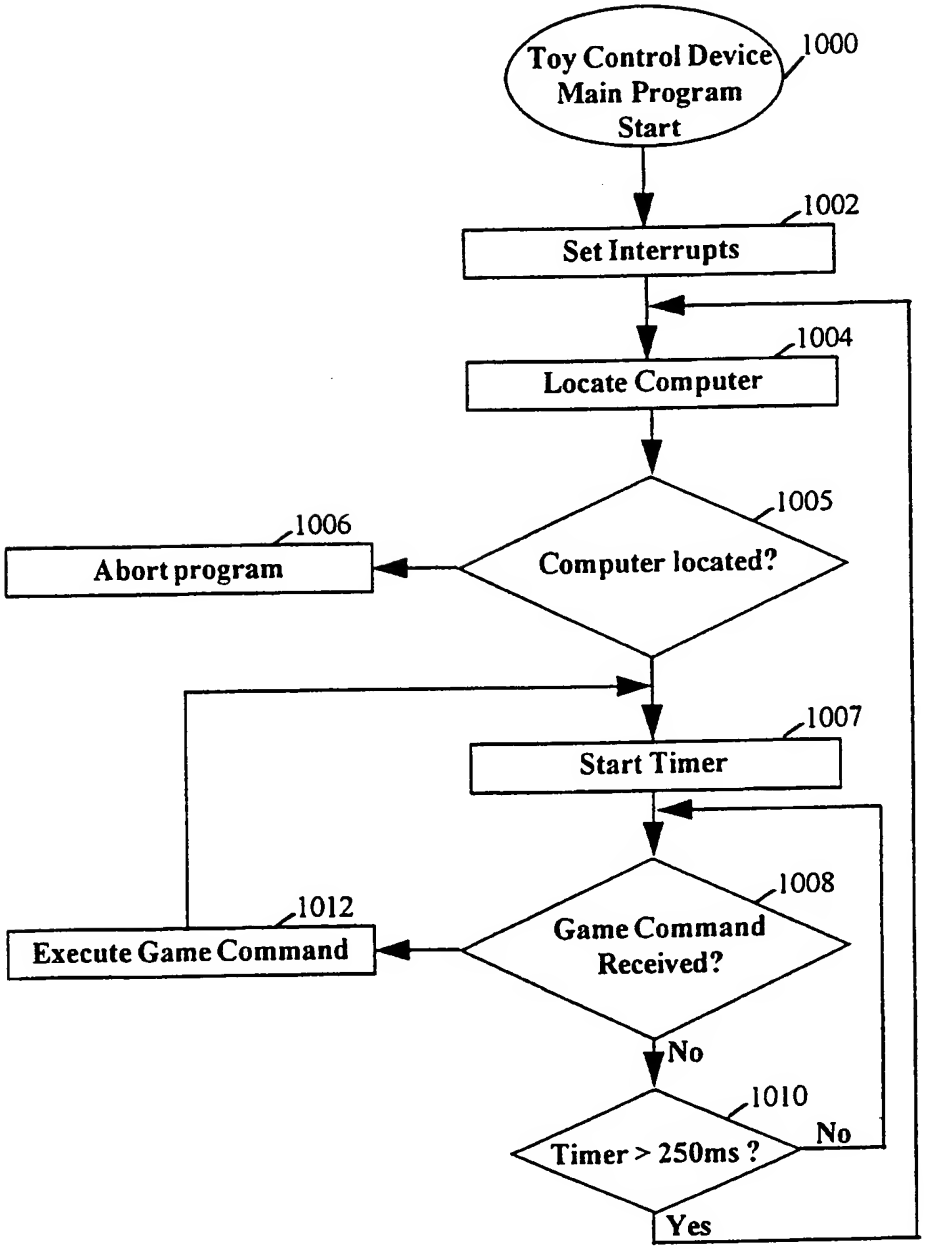
67 /150
FIGURE 16



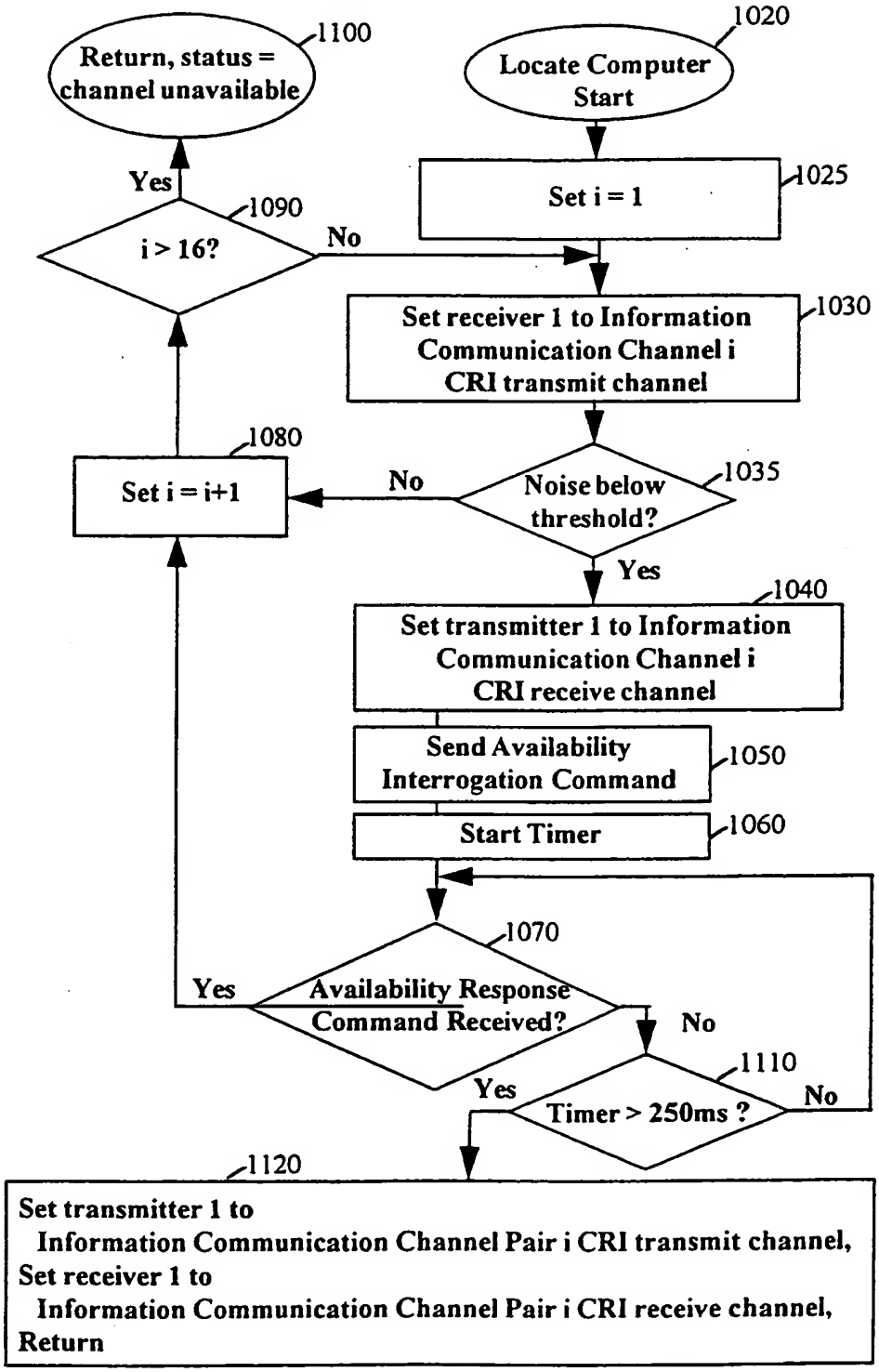
68 /150
FIGURE 17



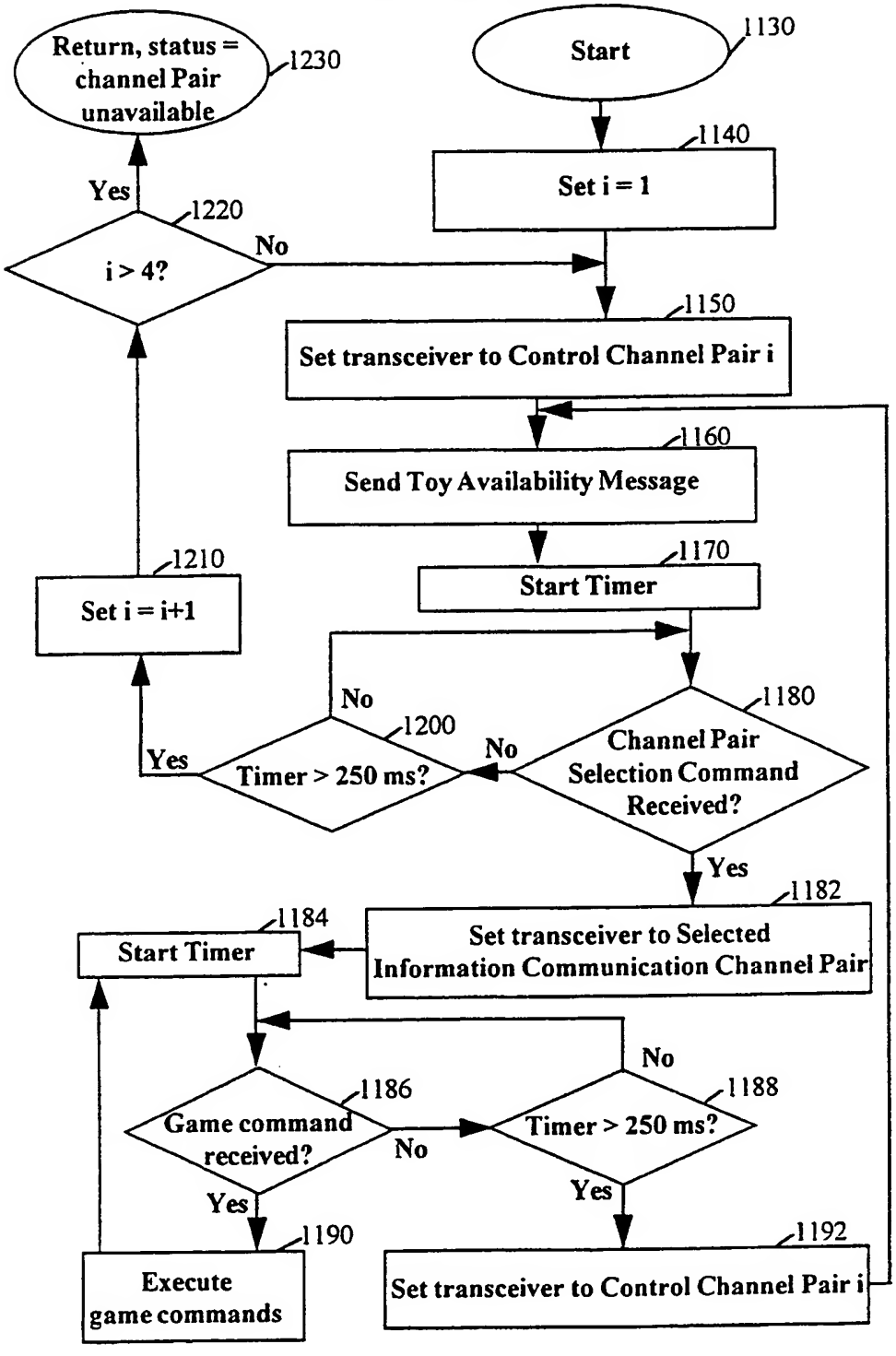
69 /150
FIGURE 18A



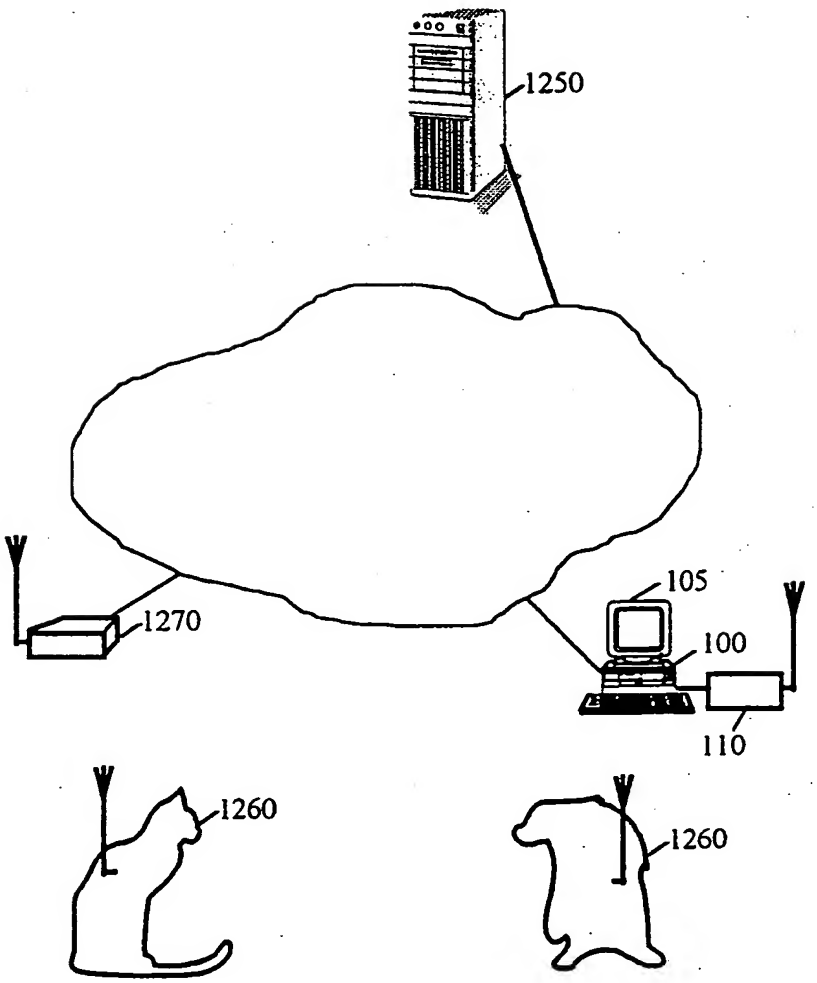
70 /150
FIGURE 18B



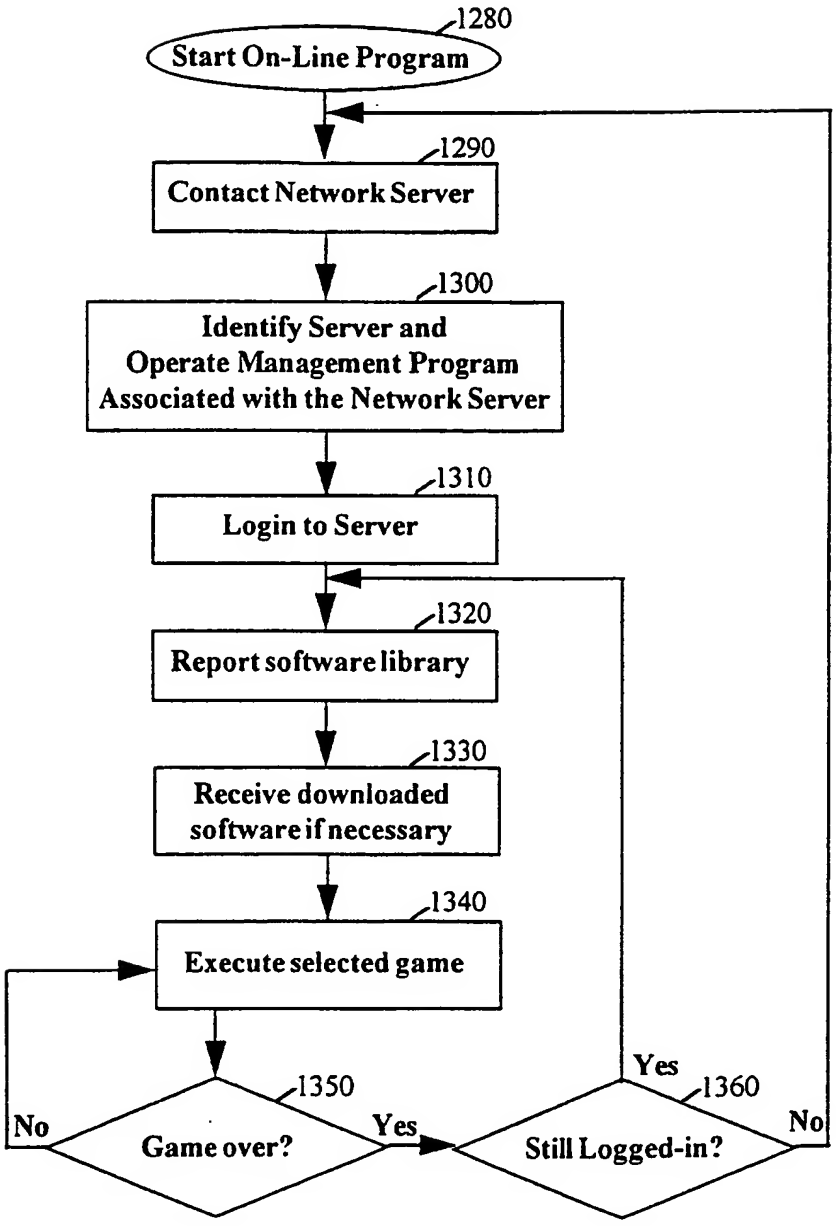
71 /150
FIGURE 19



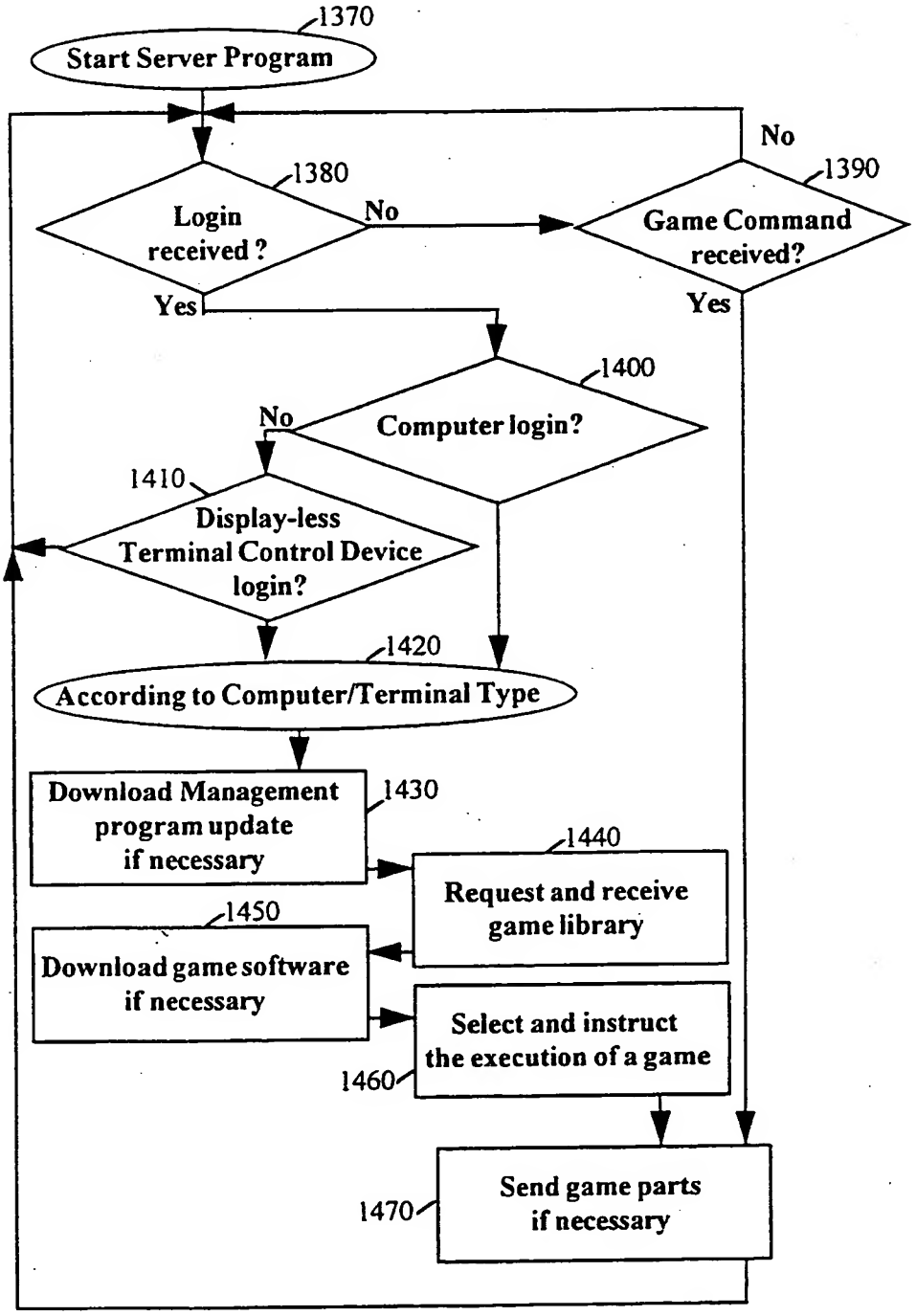
72 /150
FIGURE 20



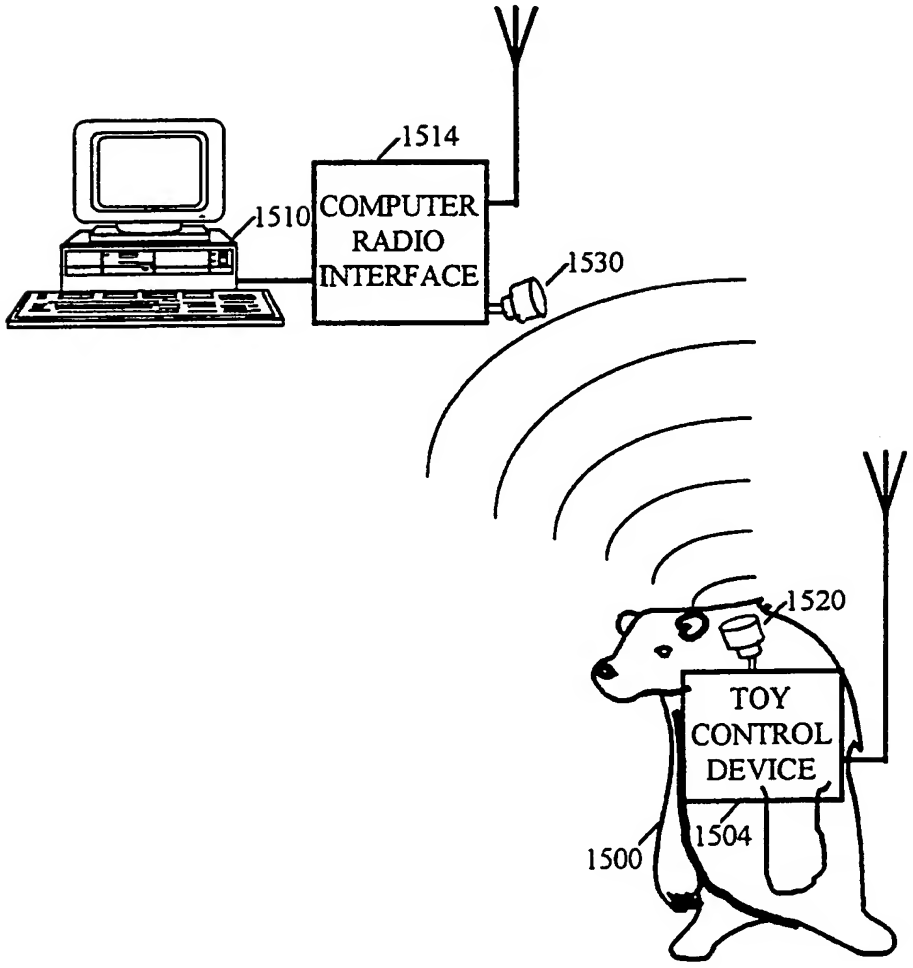
73 /150
FIGURE 21



74 /150
FIGURE 22



75 /150
FIGURE 23



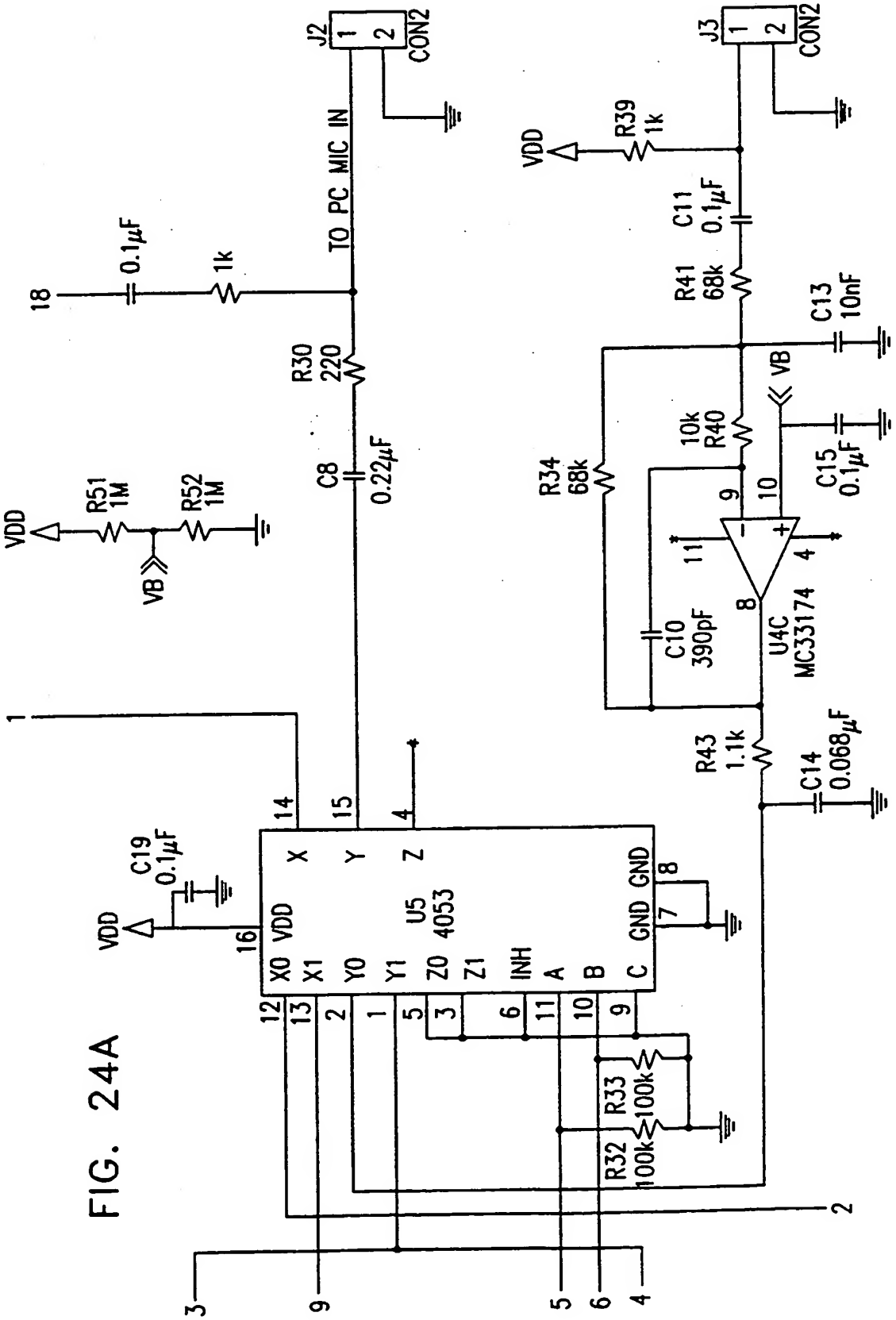

J2
CON2
TO PC MIC IN
18
0.1µF
1k
R30
220
C8
0.22µF
VDD
R51
1M
R52
1M
VB
J3
CON2
VDD
R39
1k
C11
0.1µF
R41
68k
C13
10nF
R34
68k
10k
R40
VB
C15
0.1µF
C10
390pF
U4C
MC33174
R43
1.1k
C14
0.068µF
C19
0.1µF
VDD
U5
4053
X
Y
Z
VDD
GND
GND
XO
X1
YO
Y1
ZO
Z1
INH
A
B
C
R33
100k
R32
100k
1
2
3
4
5
6
9
10
11
12
13
14
15
16

FIG. 24A

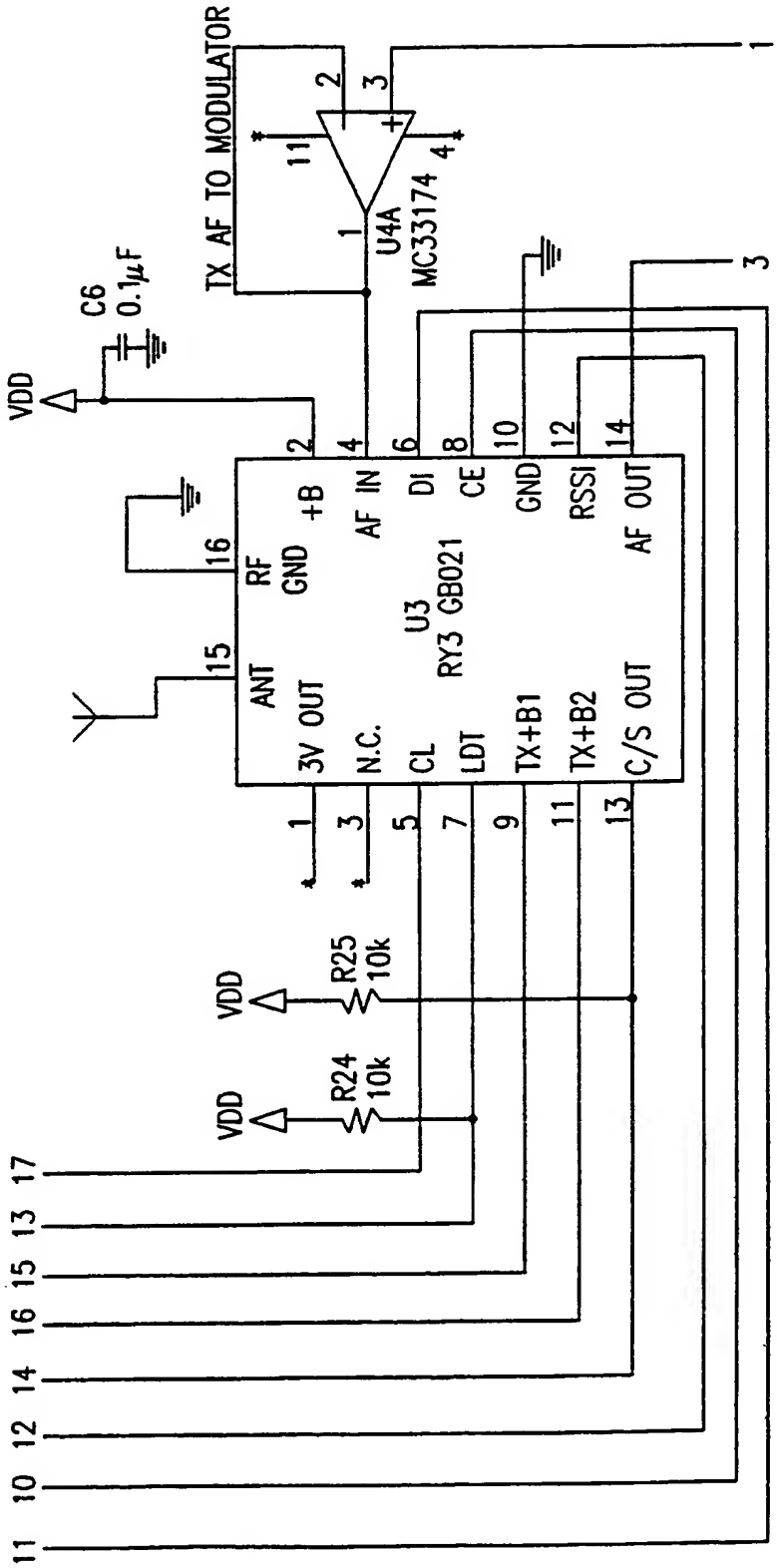

TX AF TO MODULATOR
U4A
MC33174
C6
0.1µF
VDD
U3
RY3 GB021
RF GND +B
AF IN
DI
CE
GND
RSSI
AF OUT
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
R25
10k
R24
10k

FIG. 24B

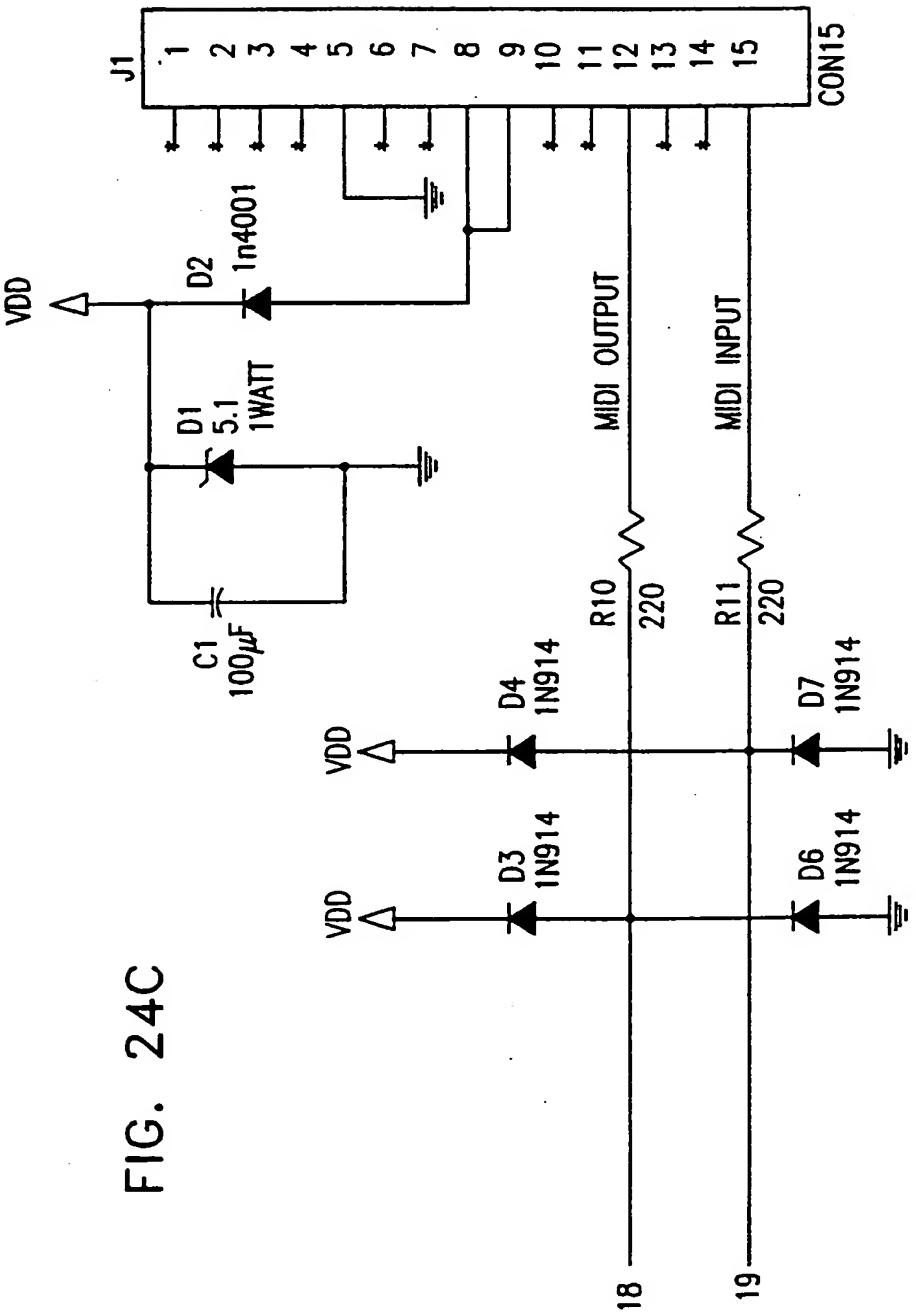
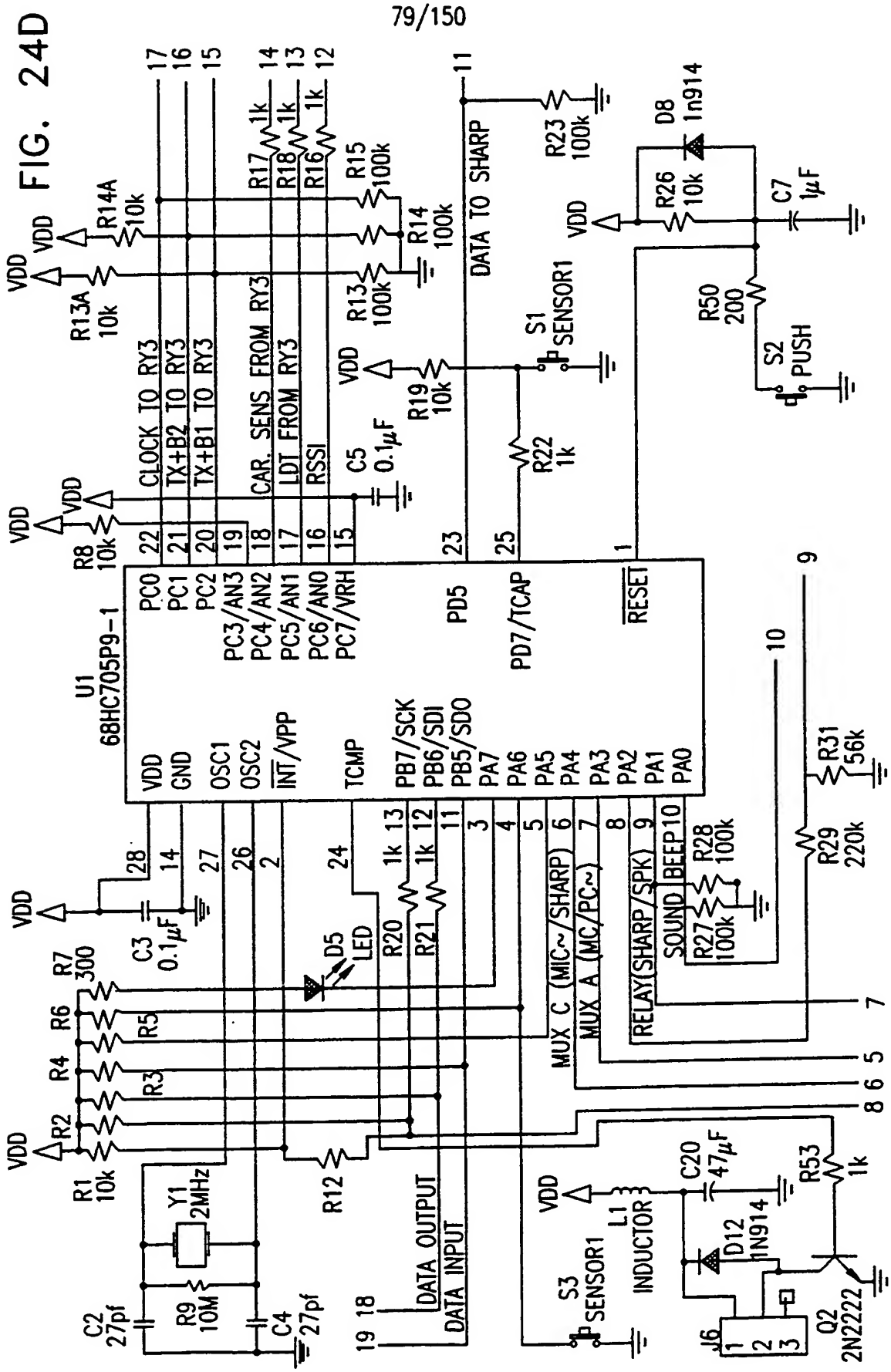

J1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
CON15
VDD
D2
1n4001
D1
5.1
1WATT
C1
100µF
MIDI OUTPUT
MIDI INPUT
R10
220
R11
220
D4
1N914
D7
1N914
D3
1N914
D6
1N914
VDD
VDD
VDD
18
19

FIG. 24C

FIG. 24D


U1
6BHC705P9-1
VDD
GND
OSC1
OSC2
INT/VPP
TCMP
PB7/SCK
PB6/SDI
PB5/SDO
PA7
PA6
PA5
PA4
PA3
PA2
PA1
PA0
PC0
PC1
PC2
PC3/AN3
PC4/AN2
PC5/AN1
PC6/AN0
PC7/VRH
PD5
PD7/TCAP
RESET
CLOCK TO RY3
TX+B2 TO RY3
TX+B1 TO RY3
CAR. SENS FROM RY3
LDT FROM RY3
RSSI
DATA TO SHARP
DATA OUTPUT
DATA INPUT
MUX C (MIC~/SHARP)
MUX A (MC/PC~)
RELAY(SHARP/SPK)
SOUND
BEEP
R1 10k
R2
R3
R4
R5
R6
R7 300
R8 10k
R9 10M
R12
R13A 10k
R13 100k
R14A 10k
R14 100k
R15 100k
R16 1k
R17 1k
R18 1k
R19 10k
R20 1k
R21 1k
R22 1k
R23 100k
R26 10k
R27 100k
R28 100k
R29 220k
R31 56k
R50 200
R53 1k
C2 27pf
C3 0.1µF
C4 27pf
C5 0.1µF
C7 1µF
C20 47µF
Y1 2MHz
D5 LED
D8 1n914
D12 1N914
L1 INDUCTOR
S1 SENSOR1
S2 PUSH
S3 SENSOR1
J6
Q2 2N2222

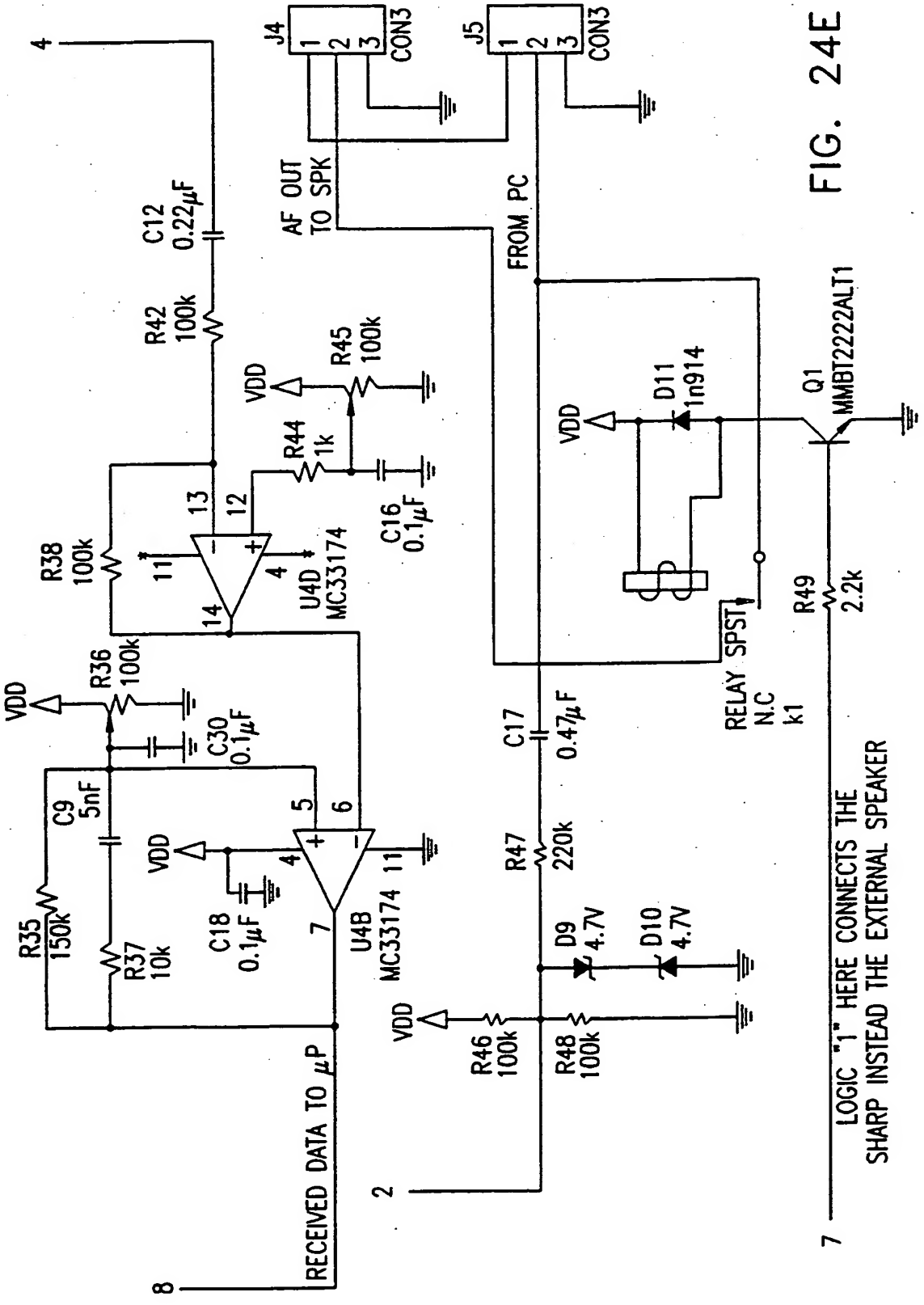

4
J4
1
2
3
CON3
J5
1
2
3
CON3
AF OUT
TO SPK
FROM PC
C12
0.22µF
R42
100k
R45
100k
VDD
R44
1k
C16
0.1µF
R38
100k
13
12
11
14
4
U4D
MC33174
D11
1n914
Q1
MMBT222ALT1
R36
100k
C30
0.1µF
RELAY SPST
N.C
k1
R49
2.2k
C17
0.47µF
C9
5nF
R35
150k
R37
10k
C18
0.1µF
5
6
4
7
11
U4B
MC33174
R47
220k
D9
4.7V
D10
4.7V
R46
100k
R48
100k
RECEIVED DATA TO µP
8
2
7
LOGIC "1" HERE CONNECTS THE
SHARP INSTEAD THE EXTERNAL SPEAKER

FIG. 24E

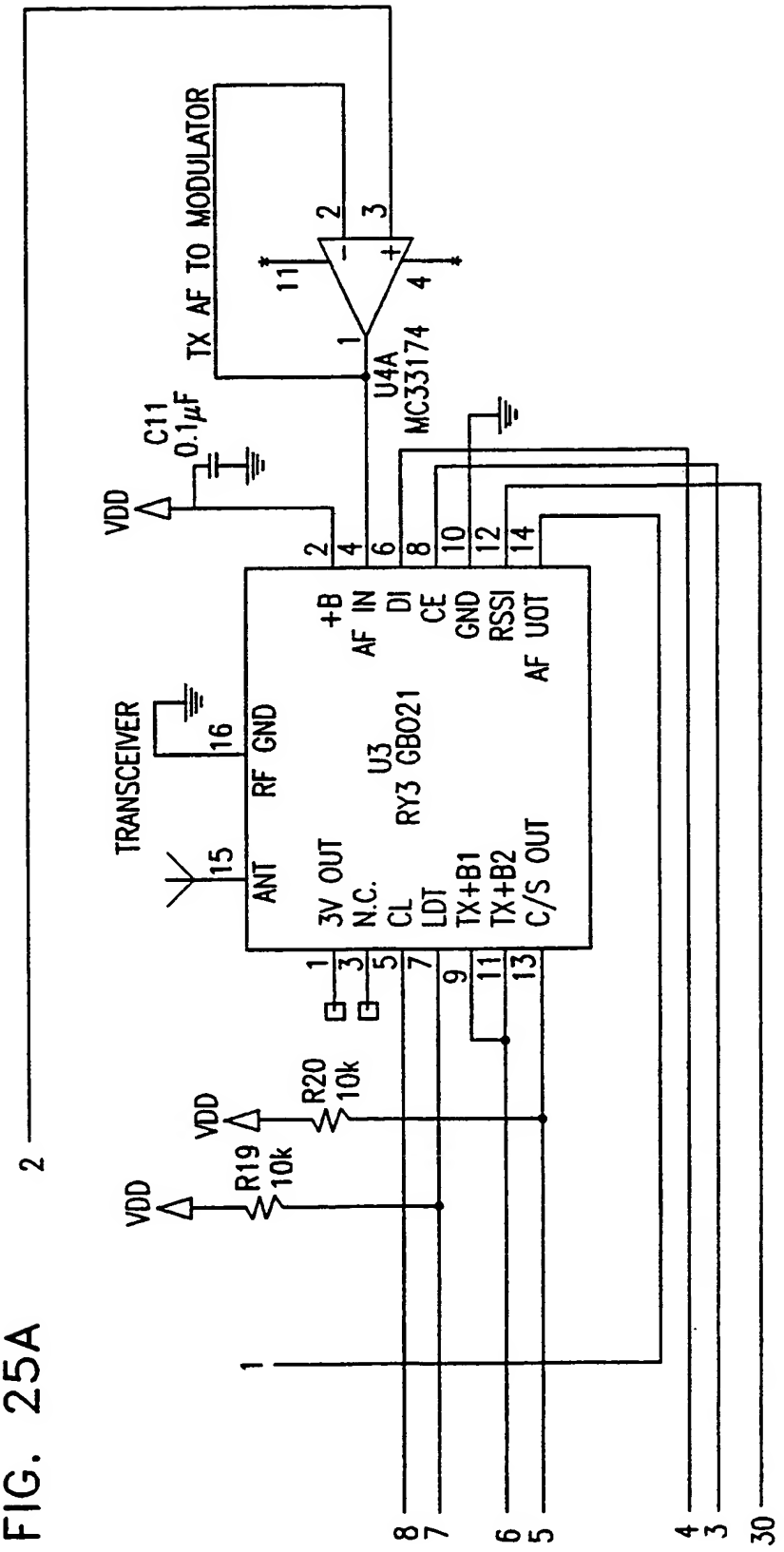

TX AF TO MODULATOR
U4A
MC33174
C11
0.1µF
VDD
TRANSCEIVER
U3
RY3 GB021
+B
AF IN
DI
CE
GND
RSSI
AF UOT
RF GND
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
R20
10k
R19
10k

FIG. 25A

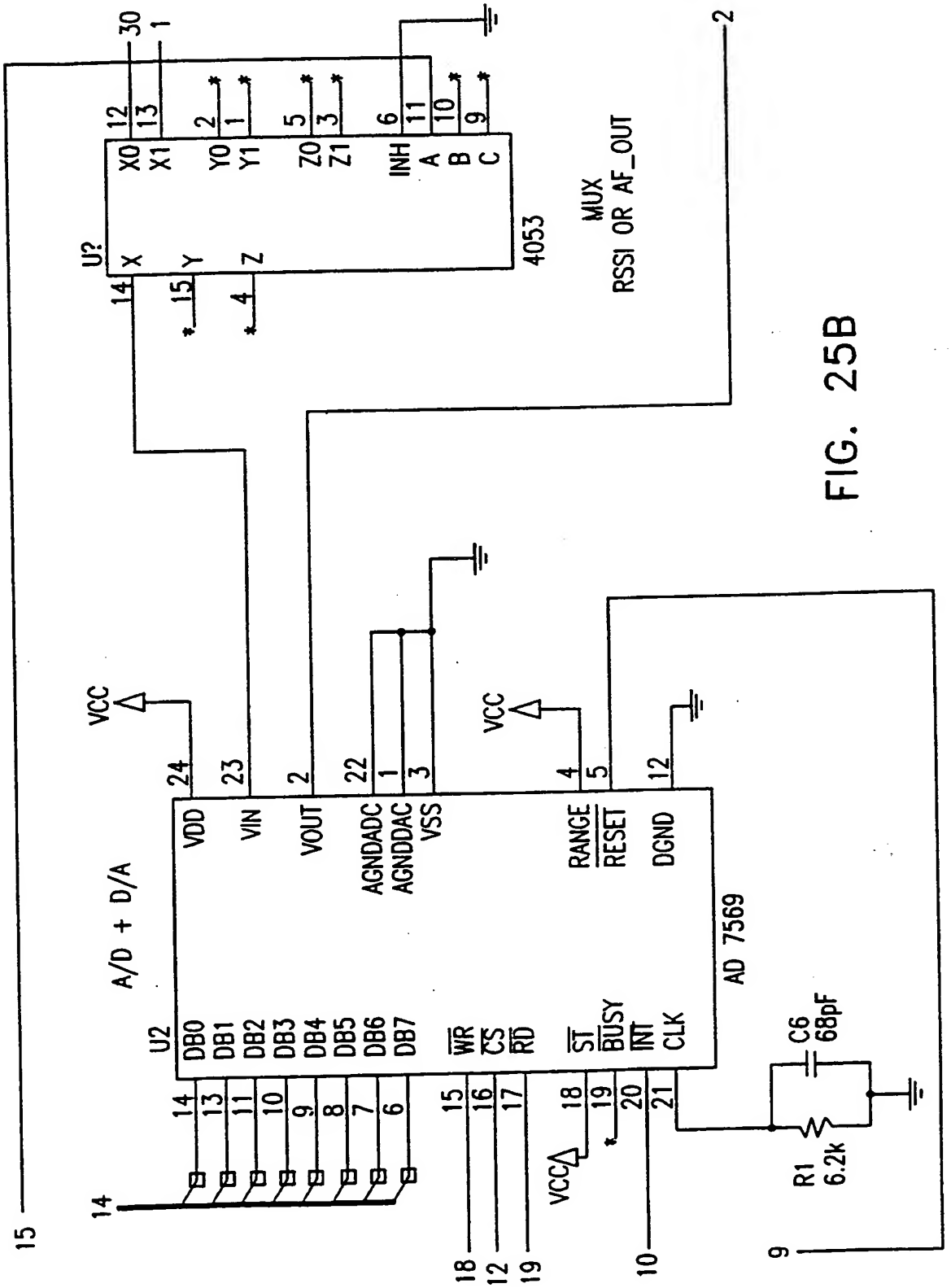

U?
4053
MUX
RSSI OR AF_OUT
A/D + D/A
U2
AD 7569
VCC
VDD
VIN
VOUT
AGNDADC
AGNDDAC
VSS
RANGE
RESET
DGND
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
WR
CS
RD
ST
BUSY
INT
CLK
C6
68pF
R1
6.2k

FIG. 25B

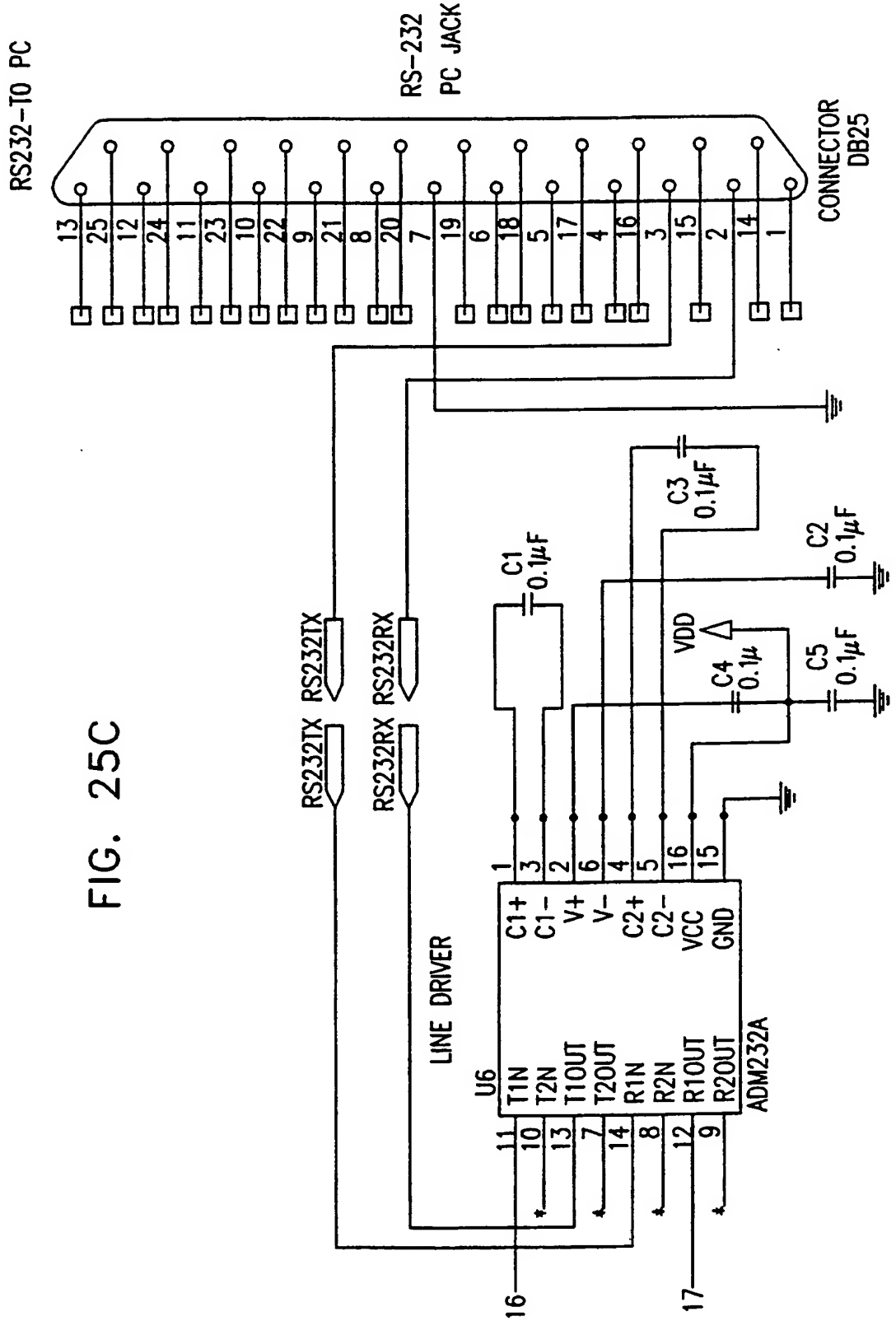

RS232-TO PC
RS-232
PC JACK
CONNECTOR
DB25
13 25 12 24 11 23 10 22 9 21 8 20 7 19 6 18 5 17 4 16 3 15 2 14 1
RS232TX
RS232RX
RS232TX
RS232RX
C1
0.1µF
C3
0.1µF
C2
0.1µF
C4
0.1µ
C5
0.1µF
VDD
LINE DRIVER
U6
ADM232A
C1+
C1-
V+
V-
C2+
C2-
VCC
GND
T1IN
T2IN
T1OUT
T2OUT
R1IN
R2IN
R1OUT
R2OUT
1 3 2 6 4 5 16 15
11 10 13 7 14 8 12 9
16
17

FIG. 25C

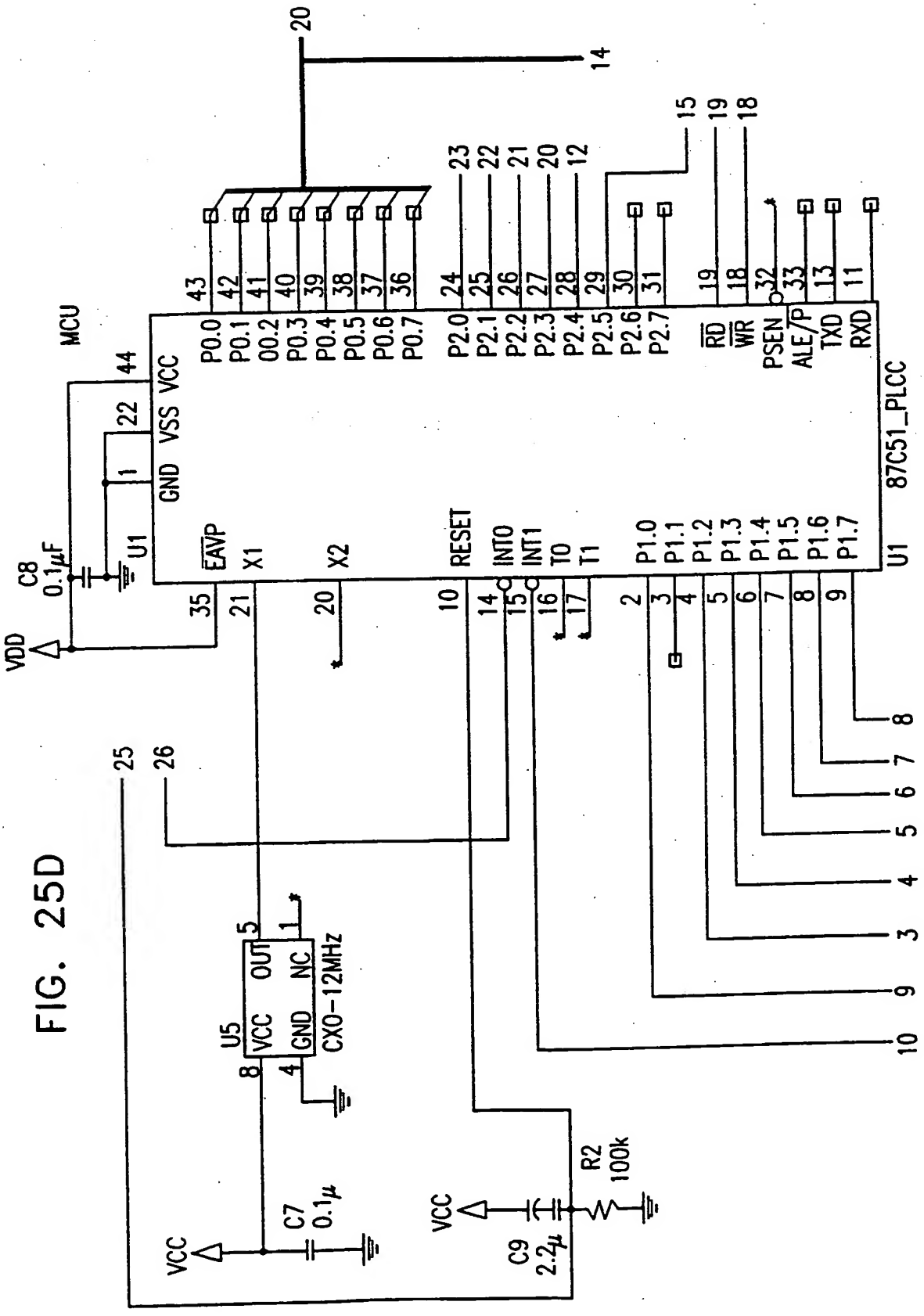

MCU
U1
87C51_PLCC
P0.0
P0.1
00.2
P0.3
P0.4
P0.5
P0.6
P0.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
RD
WR
PSEN
ALE/P
TXD
RXD
GND
VSS
VCC
EAVP
X1
X2
RESET
INT0
INT1
T0
T1
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
C8
0.1µF
VDD
U5
VCC
GND
OUT
NC
CXO-12MHz
C7
0.1µ
C9
2.2µ
R2
100k

FIG. 25D

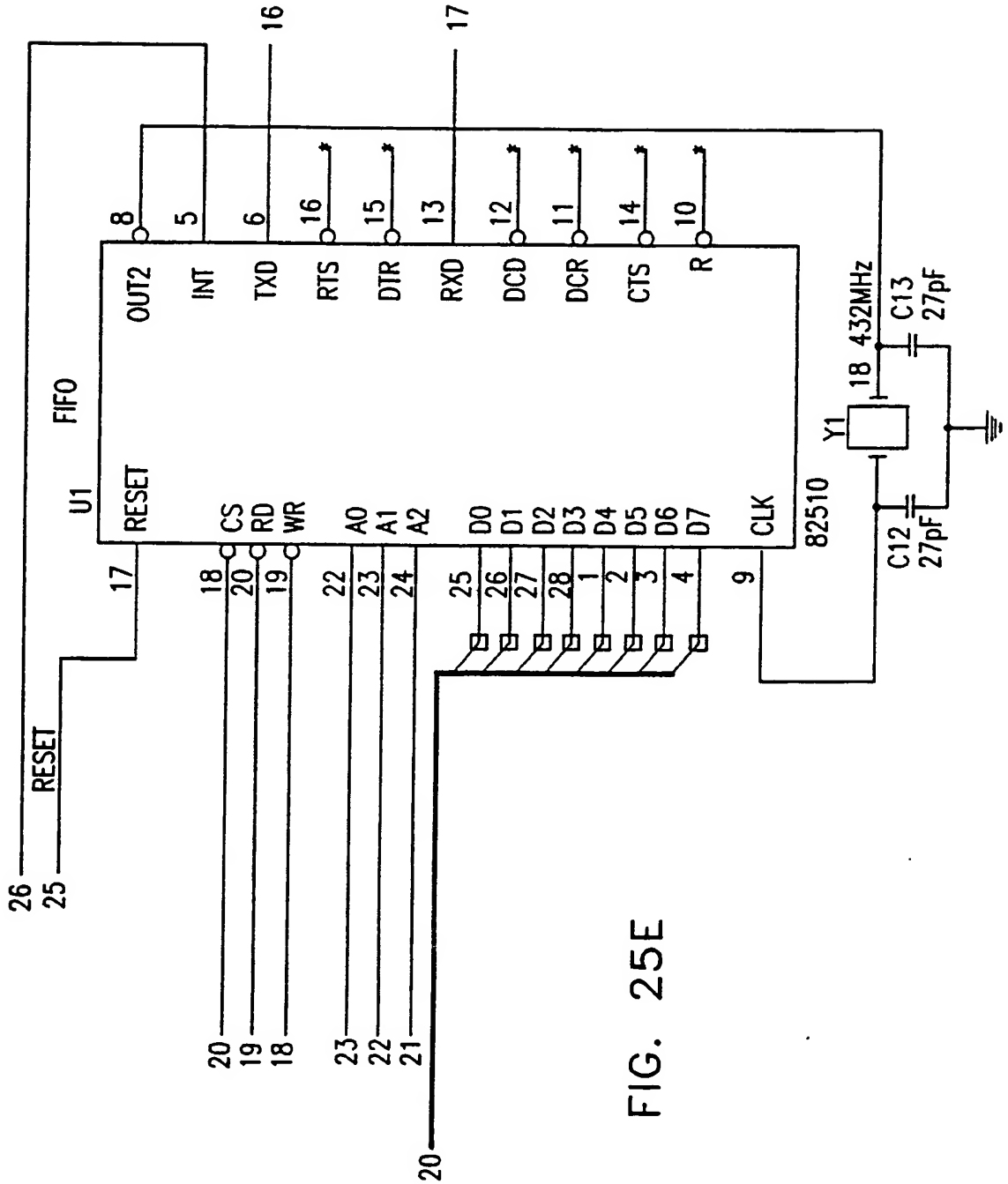

U1
82510
FIFO
RESET
OUT2
INT
TXD
RTS
DTIR
RXD
DCD
DCR
CTS
R
CS
RD
WR
A0
A1
A2
D0
D1
D2
D3
D4
D5
D6
D7
CLK
Y1
432MHz
C13
27pF
C12
27pF

FIG. 25E

FIG. 26A

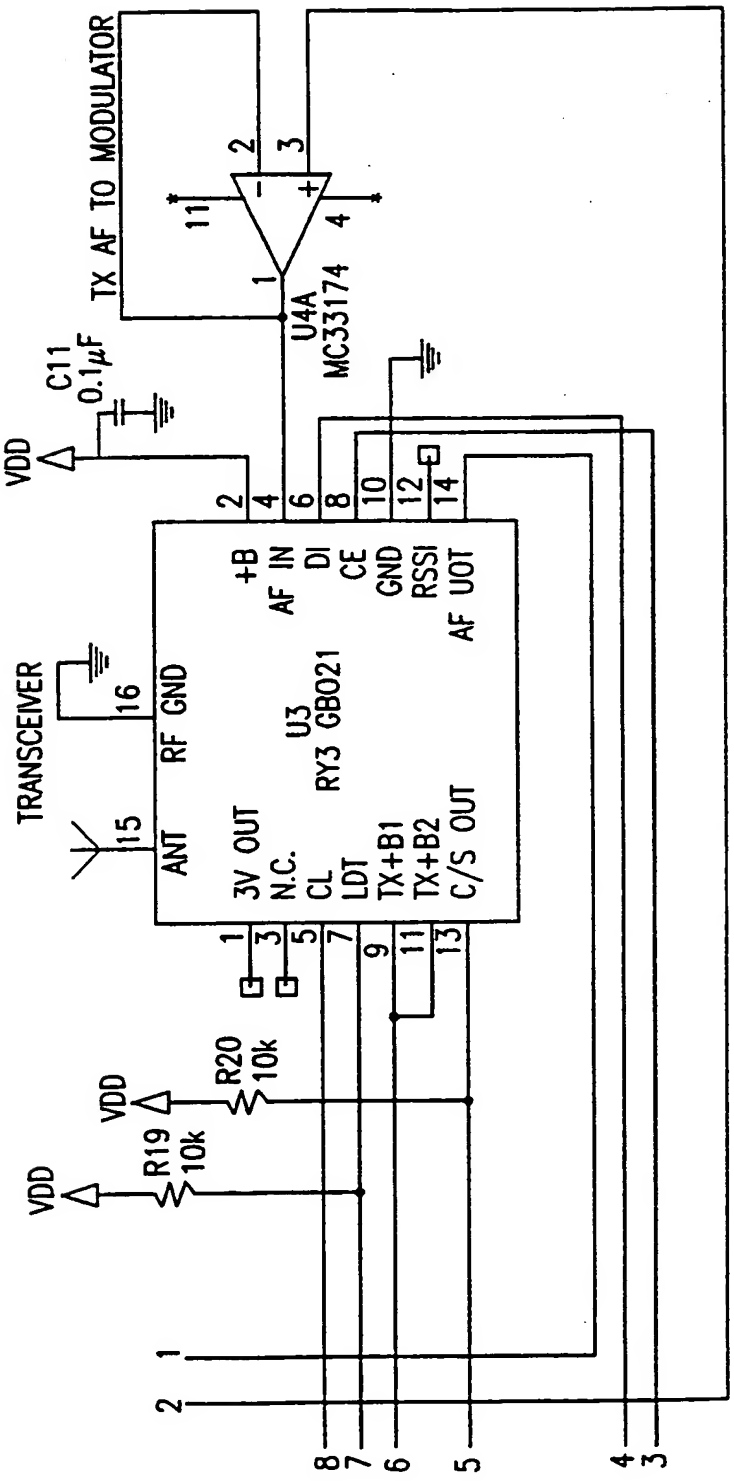
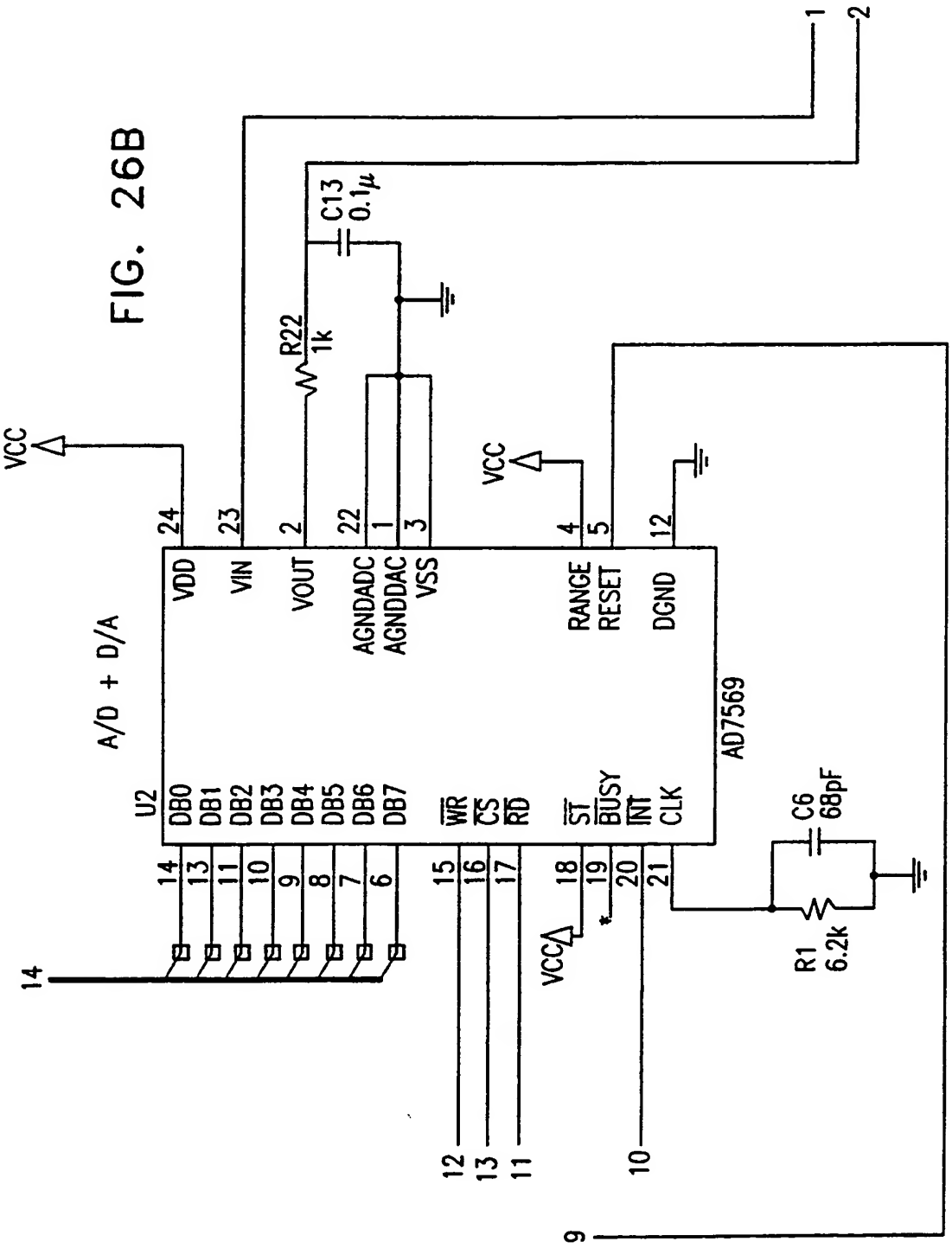

TX AF TO MODULATOR
U4A
MC33174
C11
0.1μF
VDD
TRANSCEIVER
U3
RY3 GB021
+B
AF IN
DI
CE
GND
RSSI
AF UOT
RF GND
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
R20
10k
R19
10k

FIG. 26B


A/D + D/A
U2
AD7569
VDD
VIN
VOUT
AGNDADC
AGNDDAC
VSS
RANGE
RESET
DGND
DB0
DB1
DB2
DB3
DB4
DB5
DB6
DB7
WR
CS
RD
ST
BUSY
INT
CLK
VCC
R22
1k
C13
0.1µ
C6
68pF
R1
6.2k

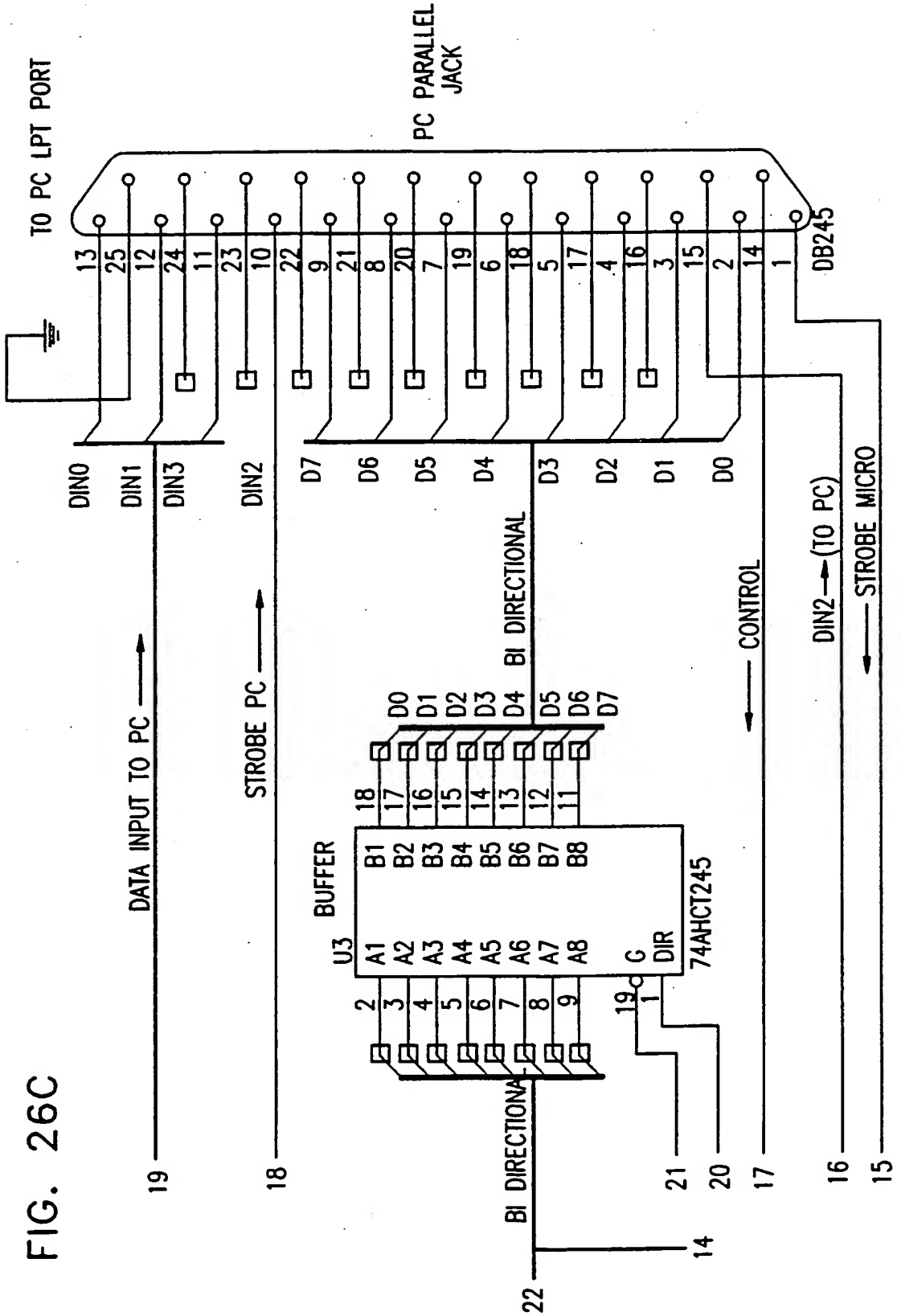

TO PC LPT PORT
PC PARALLEL JACK
DB25
DIN0
DIN1
DIN3
DIN2
D7
D6
D5
D4
D3
D2
D1
D0
DATA INPUT TO PC
STROBE PC
BI DIRECTIONAL
CONTROL
DIN2 (TO PC)
STROBE MICRO
BUFFER
U3
74AHCT245
A1
A2
A3
A4
A5
A6
A7
A8
B1
B2
B3
B4
B5
B6
B7
B8
G
DIR
BI DIRECTIONAL
19
18
21
20
17
16
15
14
22

FIG. 26C

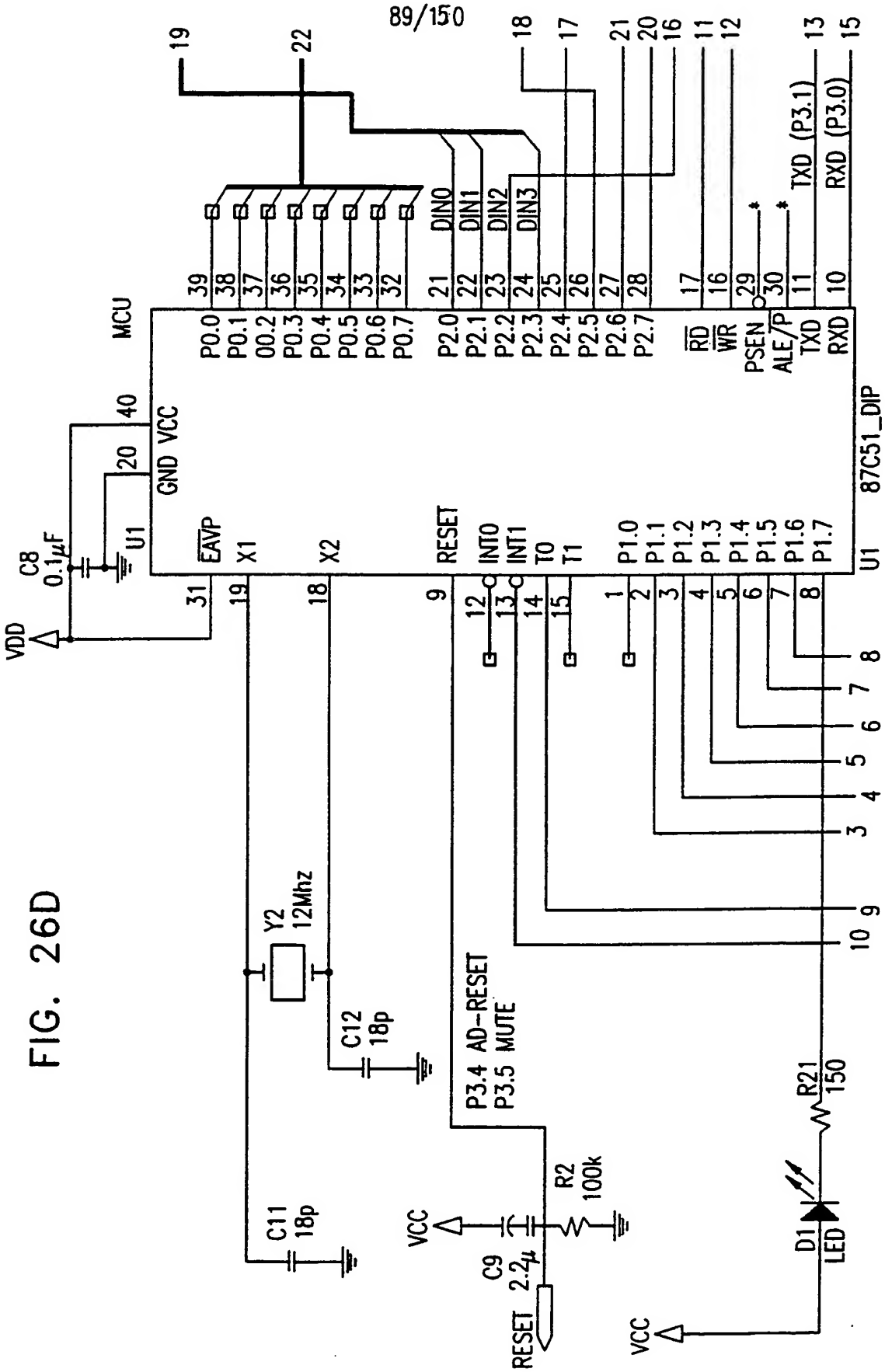
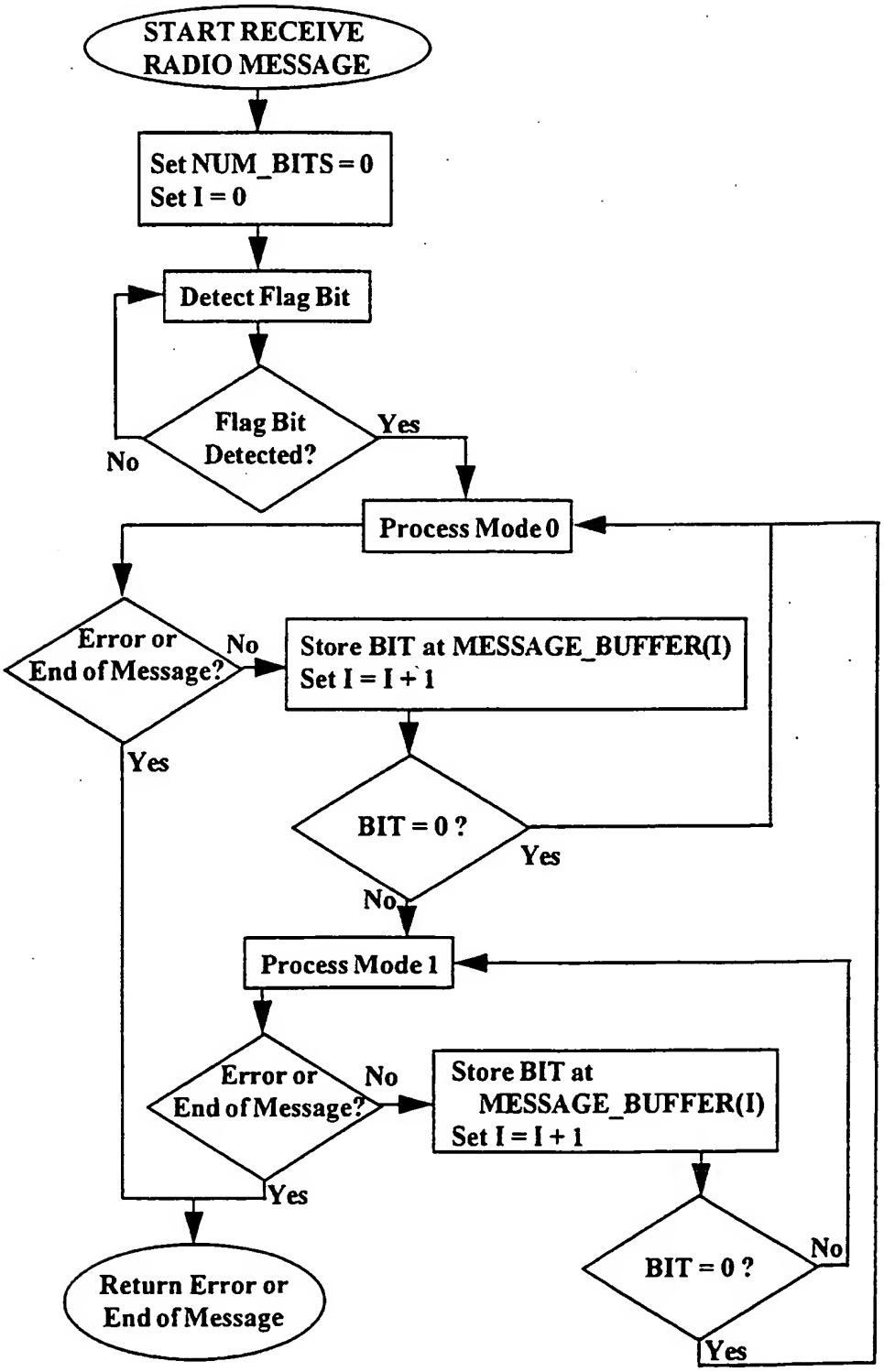

MCU
U1
87C51_DIP
GND VCC
EAVP X1 X2 RESET INT0 INT1 T0 T1 P1.0 P1.1 P1.2 P1.3 P1.4 P1.5 P1.6 P1.7
P0.0 P0.1 00.2 P0.3 P0.4 P0.5 P0.6 P0.7
P2.0 P2.1 P2.2 P2.3 P2.4 P2.5 P2.6 P2.7
RD WR PSEN ALE/P TXD RXD
DIN0 DIN1 DIN2 DIN3
TXD (P3.1)
RXD (P3.0)
C8 0.1μF
Y2 12Mhz
C12 18p
C11 18p
C9 2.2μ
R2 100k
R21 150
D1 LED
P3.4 AD-RESET
P3.5 MUTE
VDD
VCC
RESET

FIG. 26D

90 /150
FIGURE 27A



91 /150

FIGURE 27B

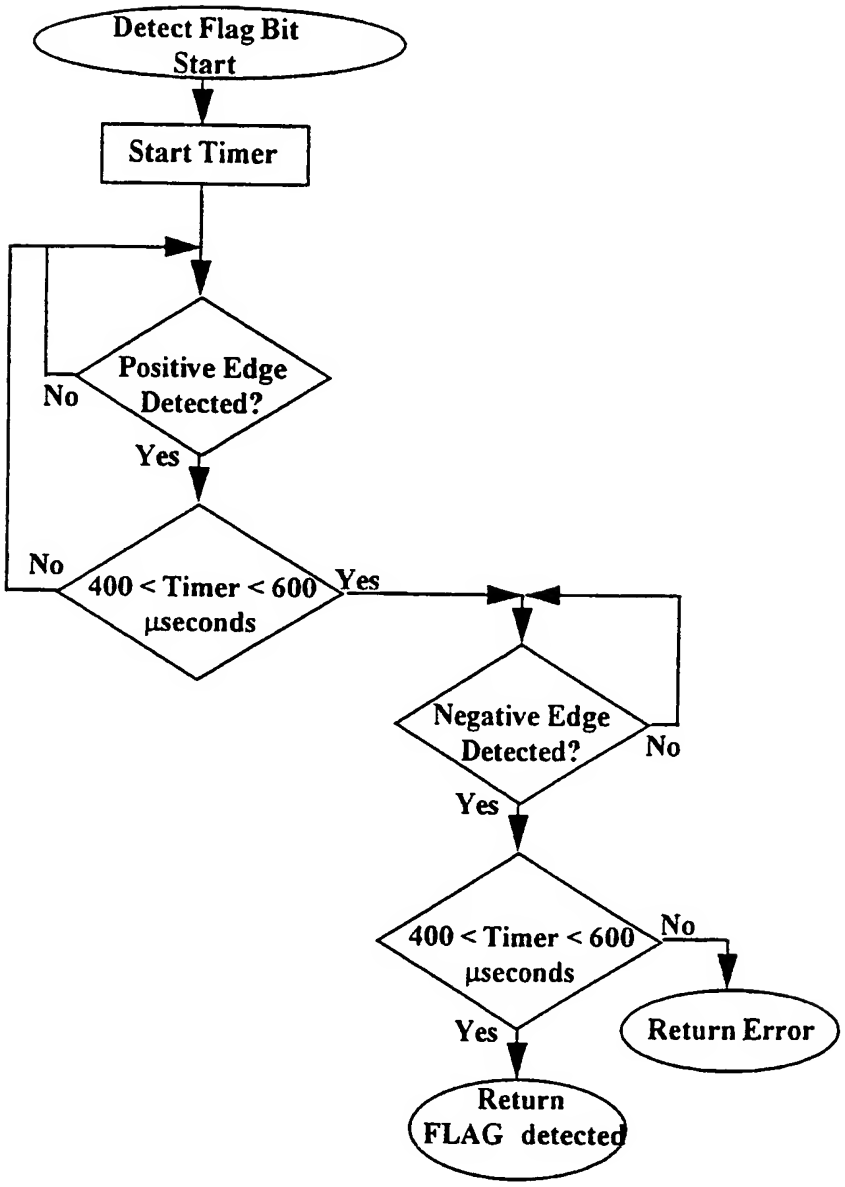
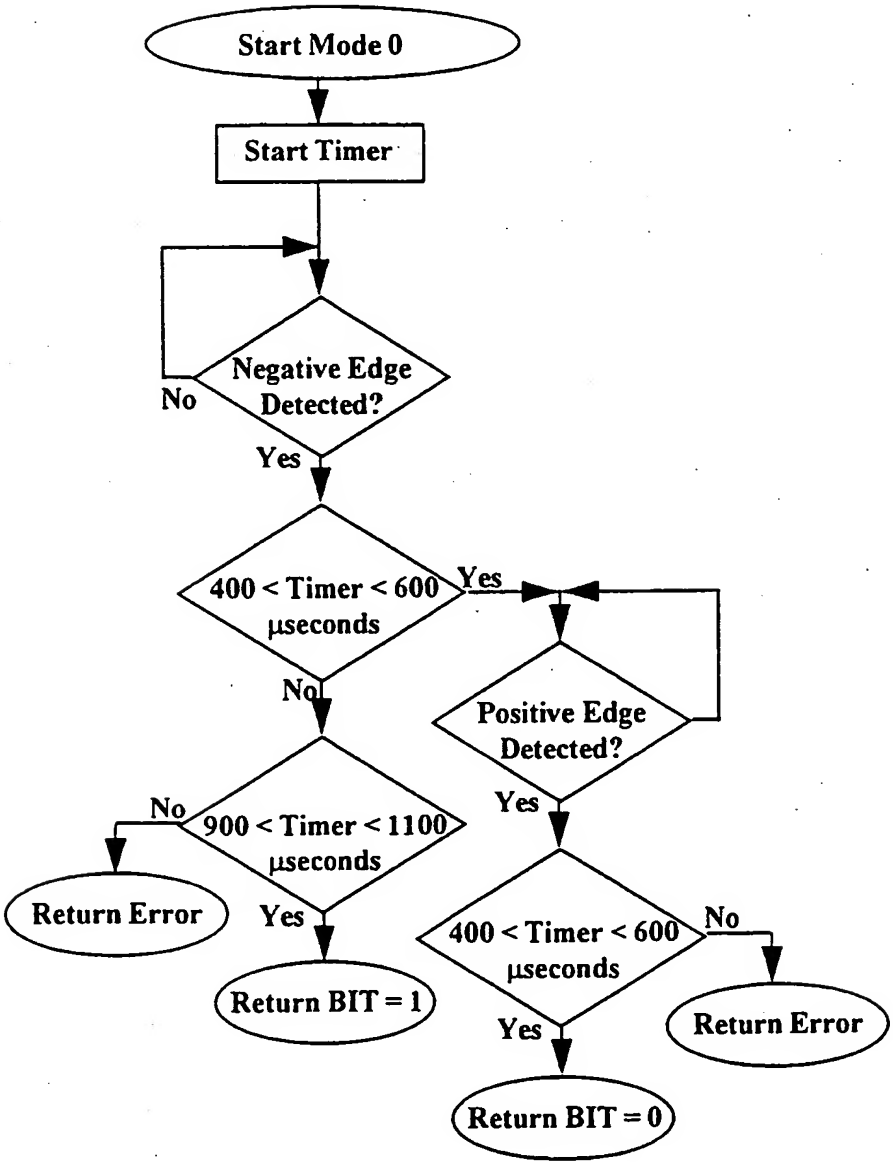
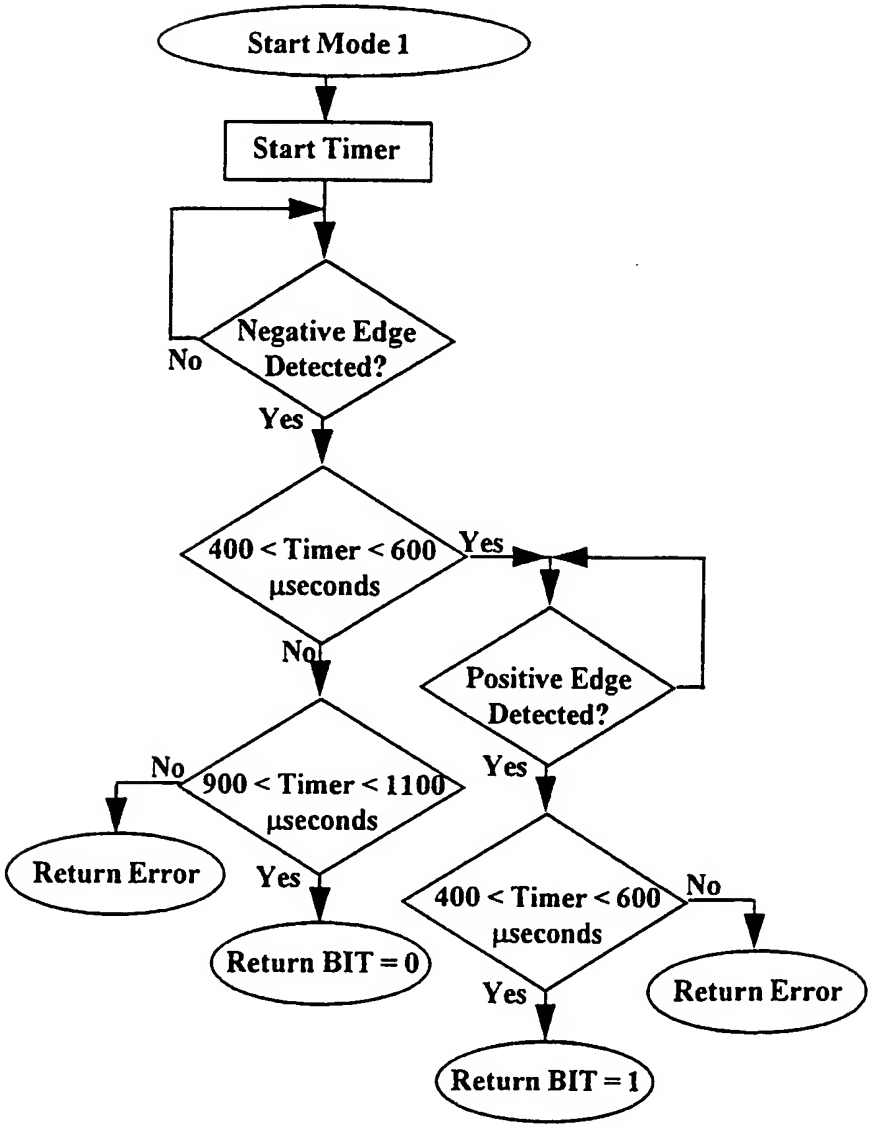


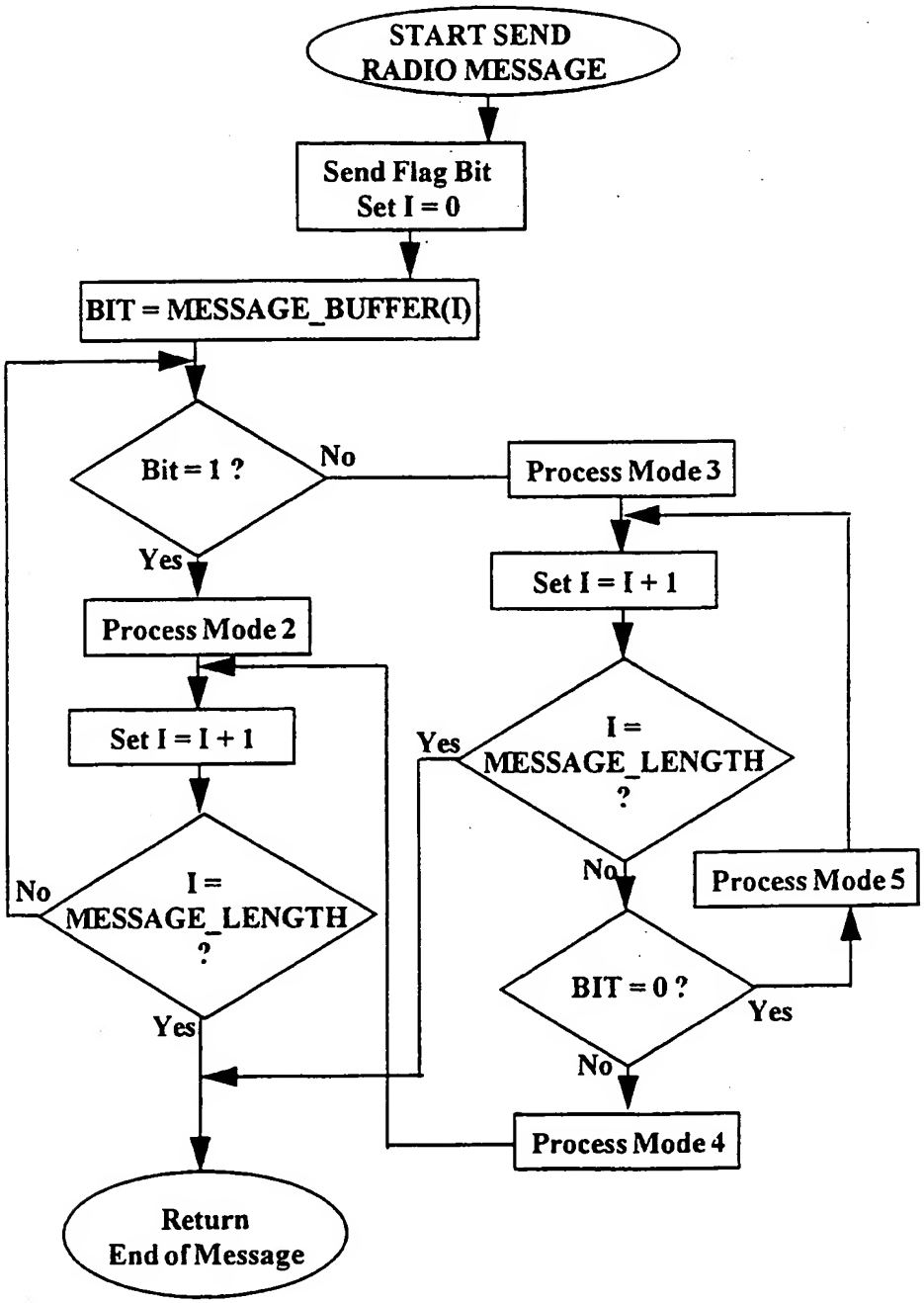
FIGURE 27C


Start Mode 0
Start Timer
Negative Edge Detected?
No
Yes
400 < Timer < 600 µseconds
Yes
No
Positive Edge Detected?
Yes
No
900 < Timer < 1100 µseconds
Return Error
Yes
Return BIT = 1
400 < Timer < 600 µseconds
No
Return Error
Yes
Return BIT = 0

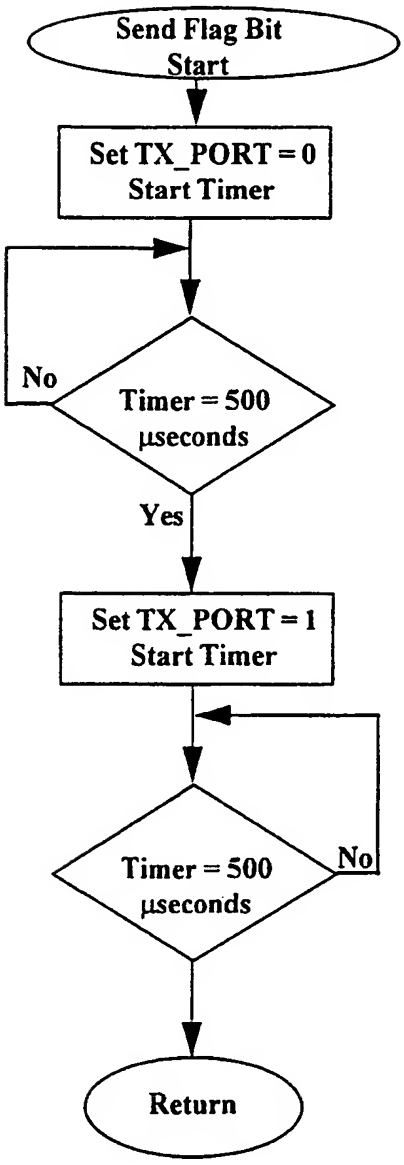
93 /150
FIGURE 27D



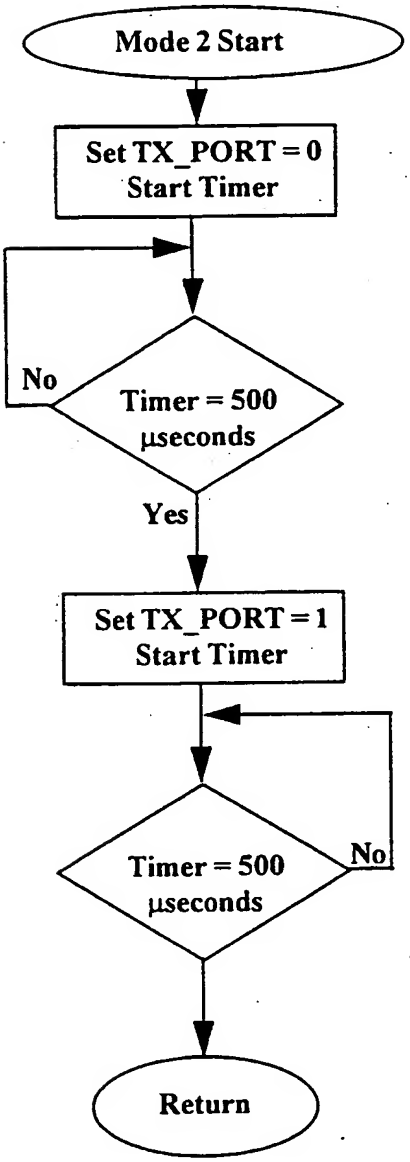
94 /150
FIGURE 27E



95 /150
FIGURE 27F



96 /150
FIGURE 27G



97 /150
FIGURE 27H

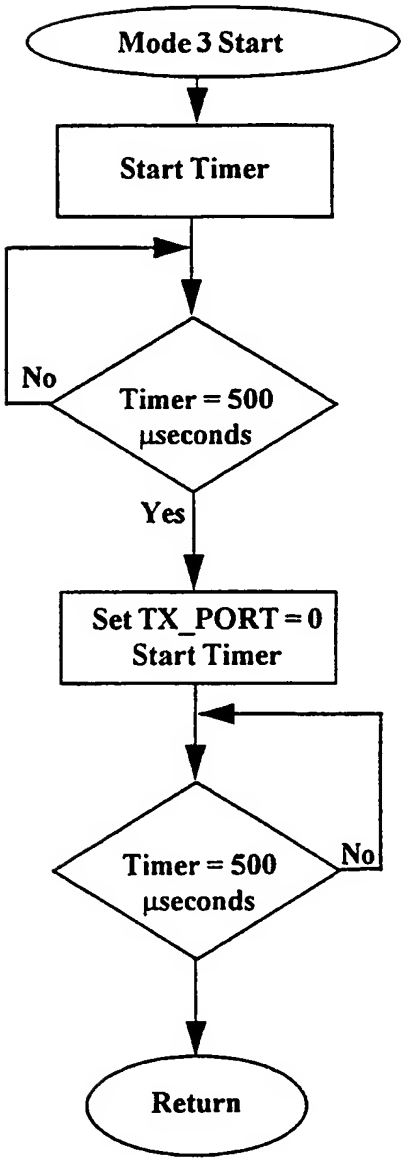
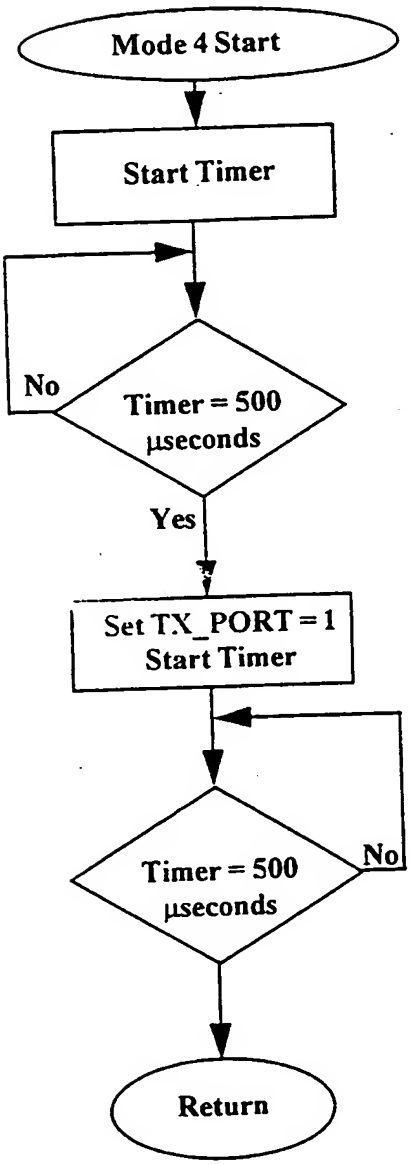
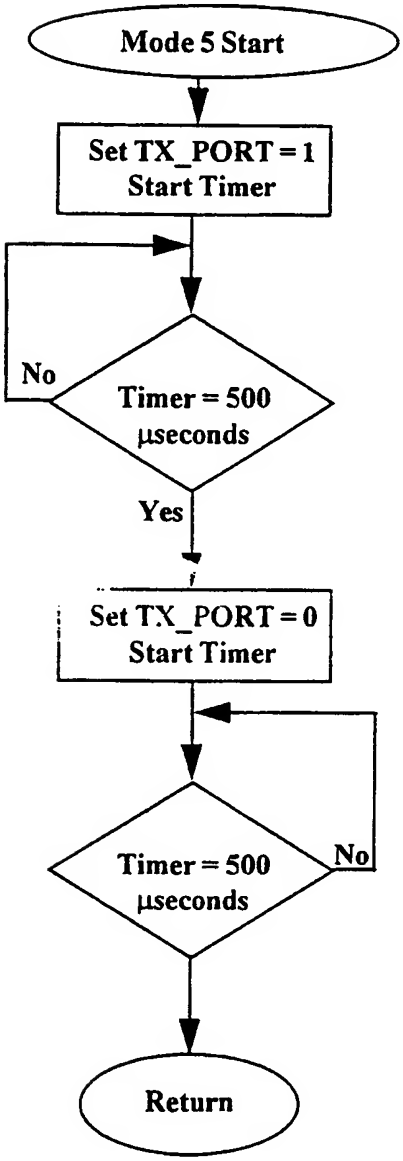


FIGURE 27I


Mode 4 Start
Start Timer
No
Timer = 500 µseconds
Yes
Set TX_PORT = 1
Start Timer
Timer = 500 µseconds
No
Return

99 /150
FIGURE 27J



100/150

FIG. 28A

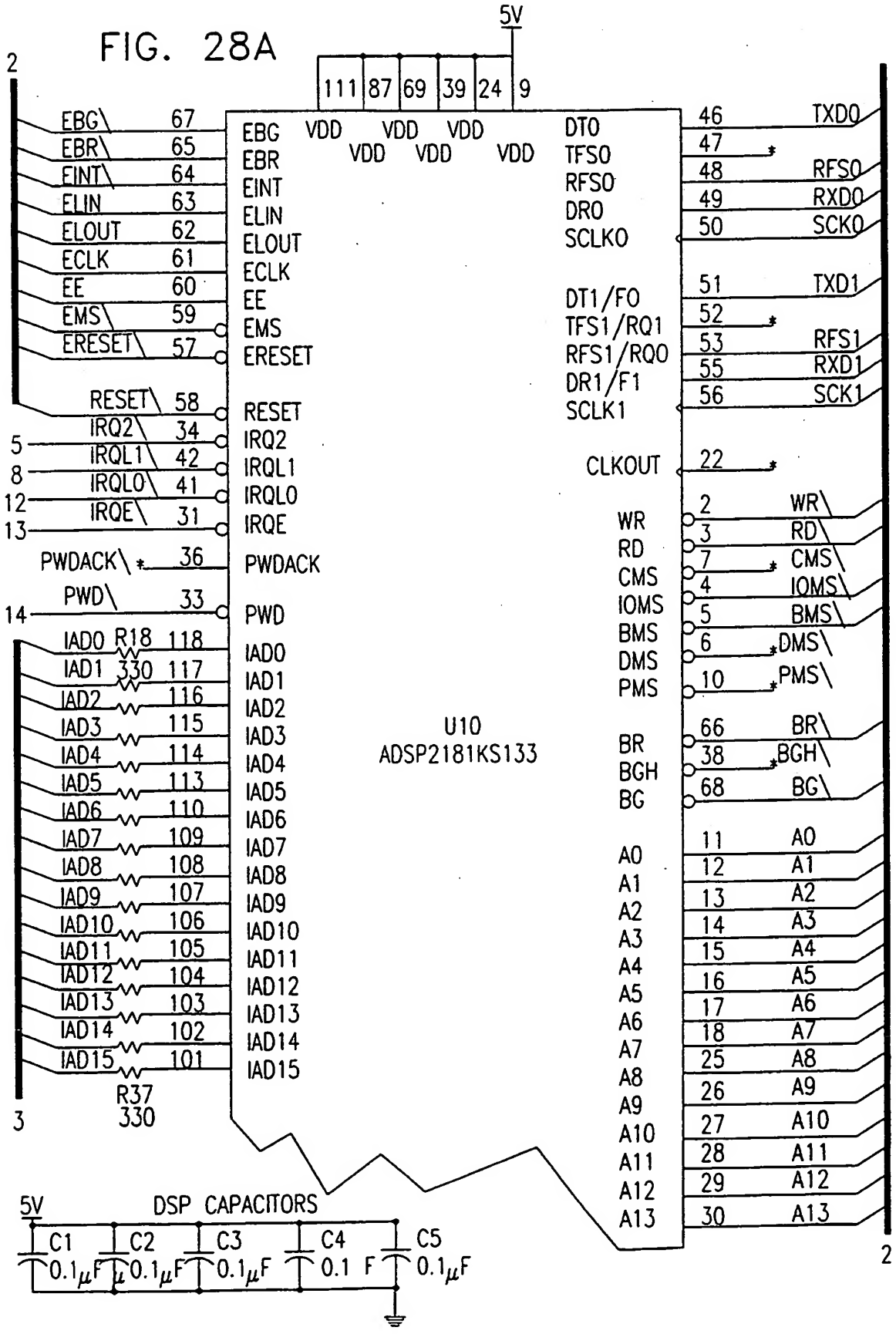
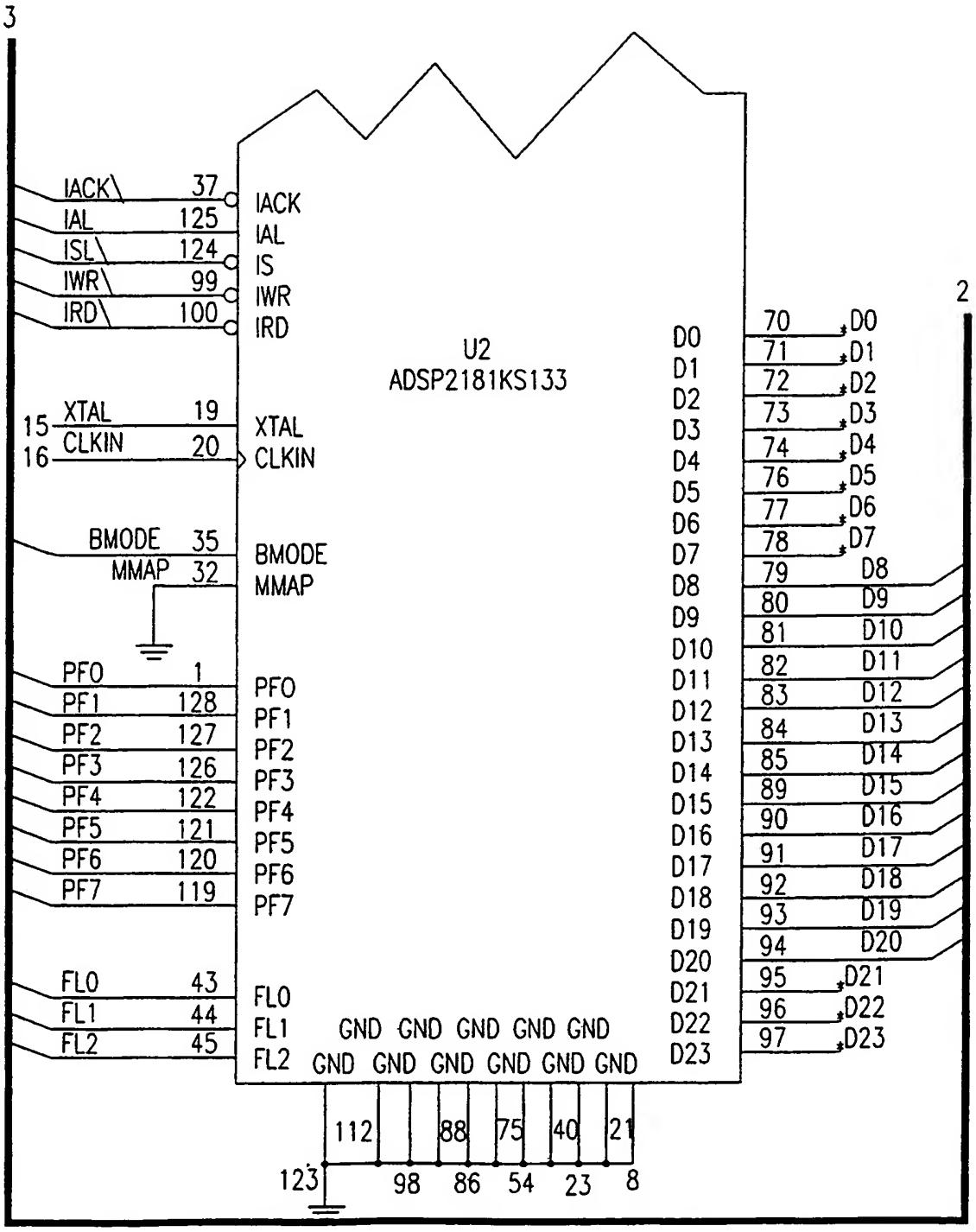


FIG. 28B


3
2
U2
ADSP2181KS133
IACK\ 37 IACK
IAL 125 IAL
ISL\ 124 IS
IWR\ 99 IWR
IRD\ 100 IRD
15 XTAL 19 XTAL
16 CLKIN 20 CLKIN
BMODE 35 BMODE
MMAP 32 MMAP
PF0 1 PF0
PF1 128 PF1
PF2 127 PF2
PF3 126 PF3
PF4 122 PF4
PF5 121 PF5
PF6 120 PF6
PF7 119 PF7
FL0 43 FL0
FL1 44 FL1
FL2 45 FL2
D0 70 D0
D1 71 D1
D2 72 D2
D3 73 D3
D4 74 D4
D5 76 D5
D6 77 D6
D7 78 D7
D8 79 D8
D9 80 D9
D10 81 D10
D11 82 D11
D12 83 D12
D13 84 D13
D14 85 D14
D15 89 D15
D16 90 D16
D17 91 D17
D18 92 D18
D19 93 D19
D20 94 D20
D21 95 D21
D22 96 D22
D23 97 D23
GND GND GND GND GND GND GND GND GND GND GND GND
112 88 75 40 21
123 98 86 54 23 8

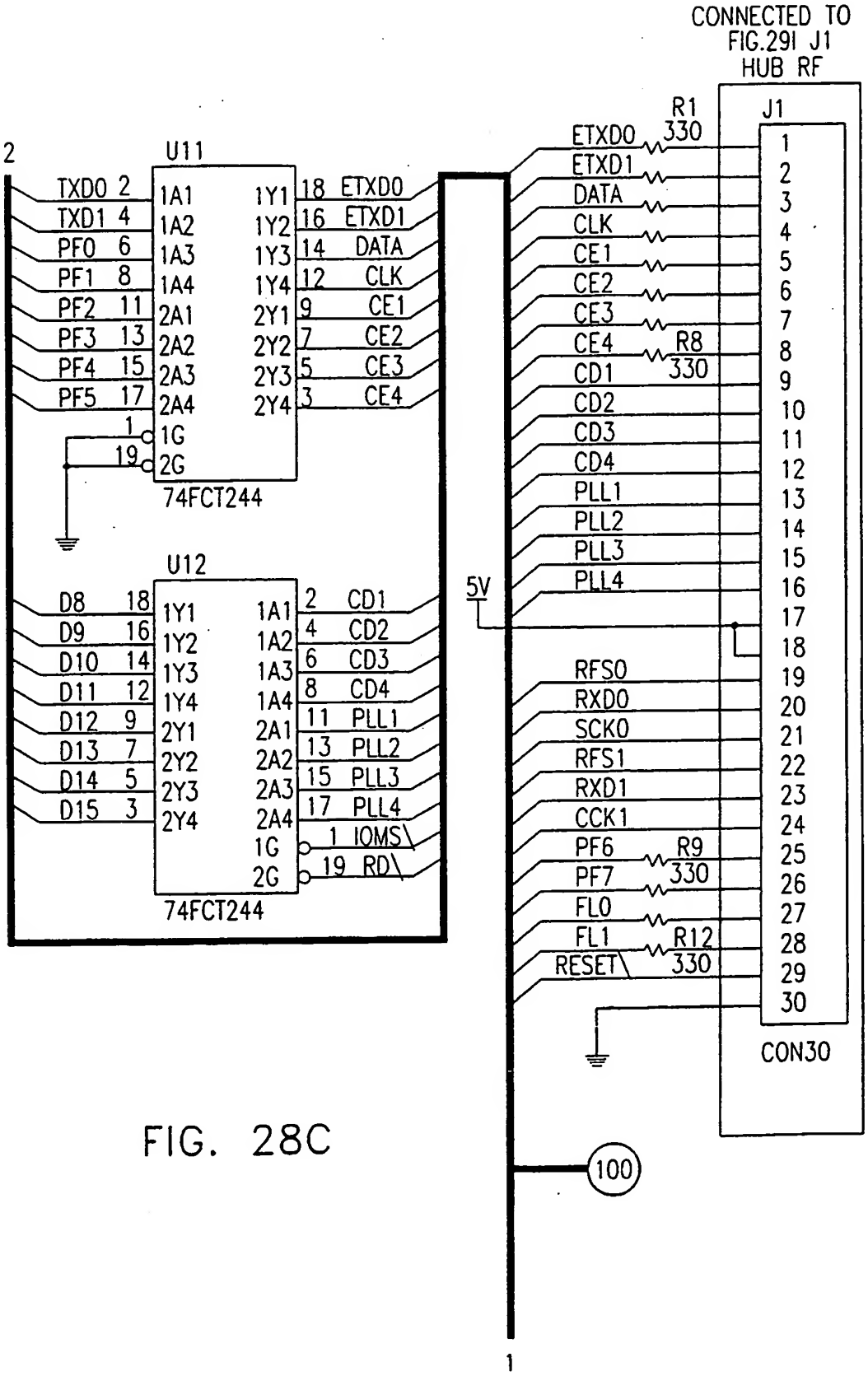
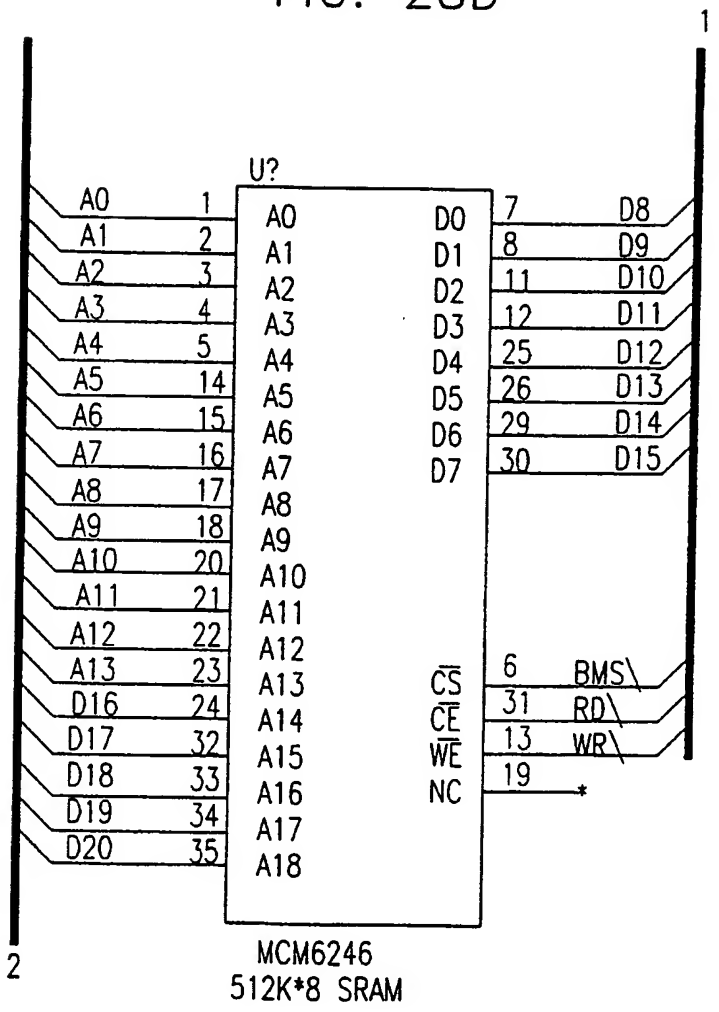

CONNECTED TO
FIG.29I J1
HUB RF
J1
R1
330
U11
U12
74FCT244
74FCT244
TXD0
TXD1
PF0
PF1
PF2
PF3
PF4
PF5
1G
2G
1A1
1A2
1A3
1A4
2A1
2A2
2A3
2A4
1Y1
1Y2
1Y3
1Y4
2Y1
2Y2
2Y3
2Y4
ETXD0
ETXD1
DATA
CLK
CE1
CE2
CE3
CE4
D8
D9
D10
D11
D12
D13
D14
D15
CD1
CD2
CD3
CD4
PLL1
PLL2
PLL3
PLL4
IOMS\
RD\
5V
RFS0
RXD0
SCK0
RFS1
RXD1
CCK1
PF6
PF7
FL0
FL1
RESET\
R8
R9
R12
CON30
100

FIG. 28C

FIG. 28D


1
2
U?
A0 1
A1 2
A2 3
A3 4
A4 5
A5 14
A6 15
A7 16
A8 17
A9 18
A10 20
A11 21
A12 22
A13 23
D16 24
D17 32
D18 33
D19 34
D20 35
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
D0
D1
D2
D3
D4
D5
D6
D7
CS
CE
WE
NC
7 D8
8 D9
11 D10
12 D11
25 D12
26 D13
29 D14
30 D15
6 BMS\
31 RD\
13 WR\
19
MCM6246
512K*8 SRAM

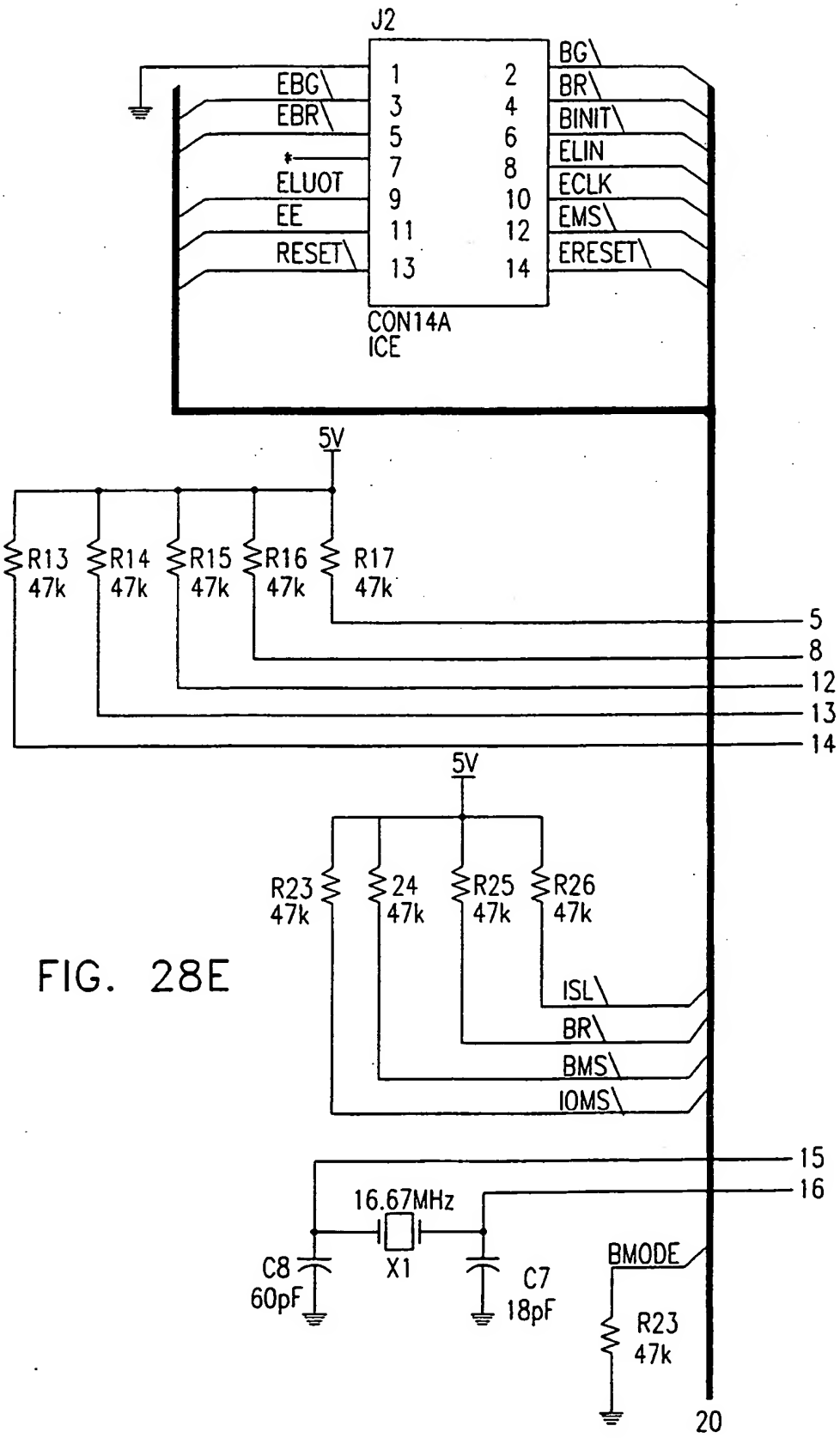

J2
EBG\
EBR\
ELUOT
EE
RESET\
1
3
5
7
9
11
13
2
4
6
8
10
12
14
BG\
BR\
BINIT\
ELIN
ECLK
EMS\
ERESET\
CON14A
ICE
5V
R13 47k
R14 47k
R15 47k
R16 47k
R17 47k
5
8
12
13
14
5V
R23 47k
24 47k
R25 47k
R26 47k
ISL\
BR\
BMS\
IOMS\
15
16
16.67MHz
C8 60pF
X1
C7 18pF
BMODE
R23 47k
20

FIG. 28E

FIG. 28F

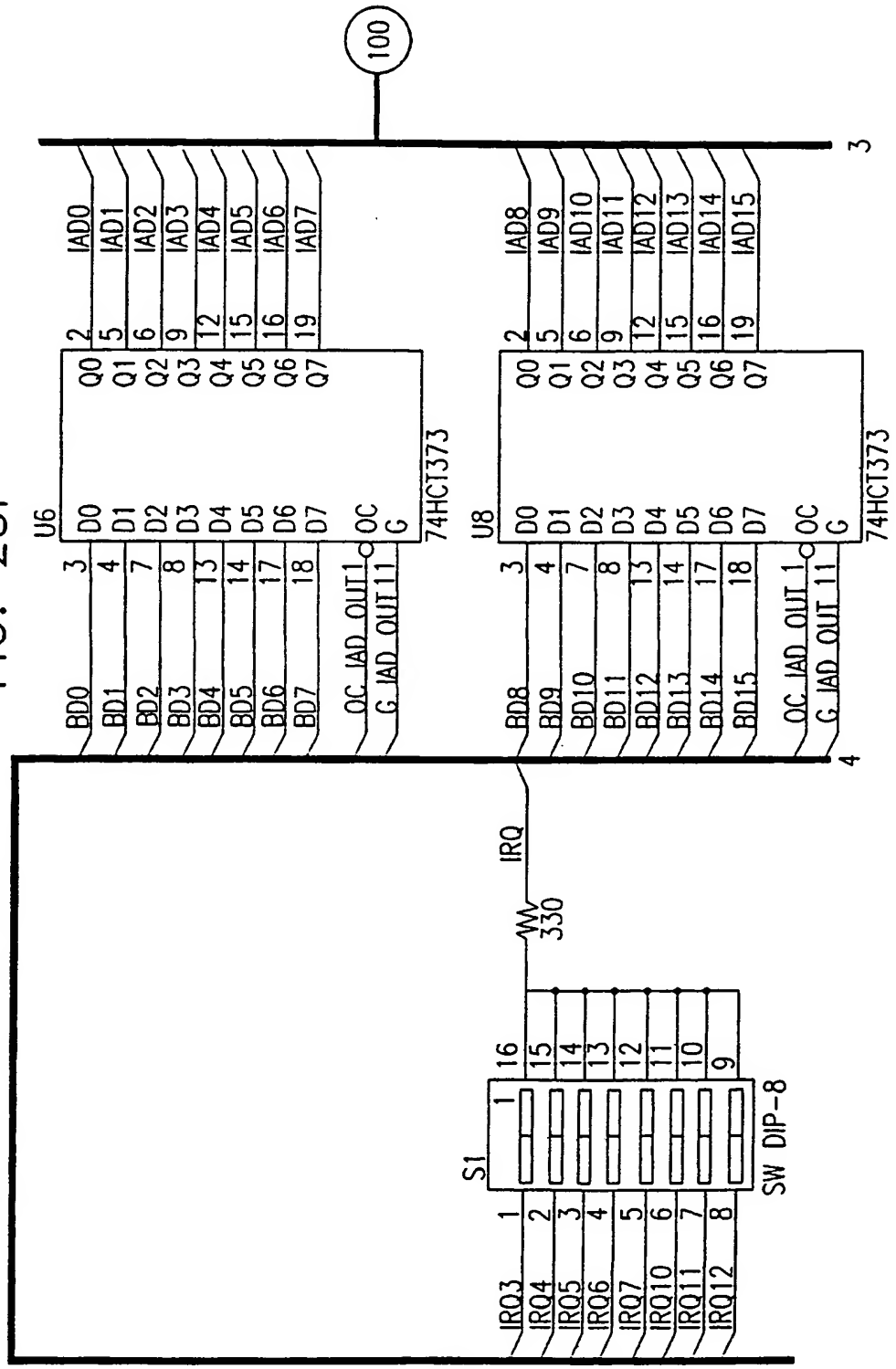

100
3
IAD0
IAD1
IAD2
IAD3
IAD4
IAD5
IAD6
IAD7
IAD8
IAD9
IAD10
IAD11
IAD12
IAD13
IAD14
IAD15
U6
U8
74HCT373
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
D0
D1
D2
D3
D4
D5
D6
D7
OC
G
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
BD8
BD9
BD10
BD11
BD12
BD13
BD14
BD15
OC_IAD_OUT1
G_IAD_OUT11
4
IRQ
330
S1
SW DIP-8
IRQ3
IRQ4
IRQ5
IRQ6
IRQ7
IRQ10
IRQ11
IRQ12

FIG. 28G

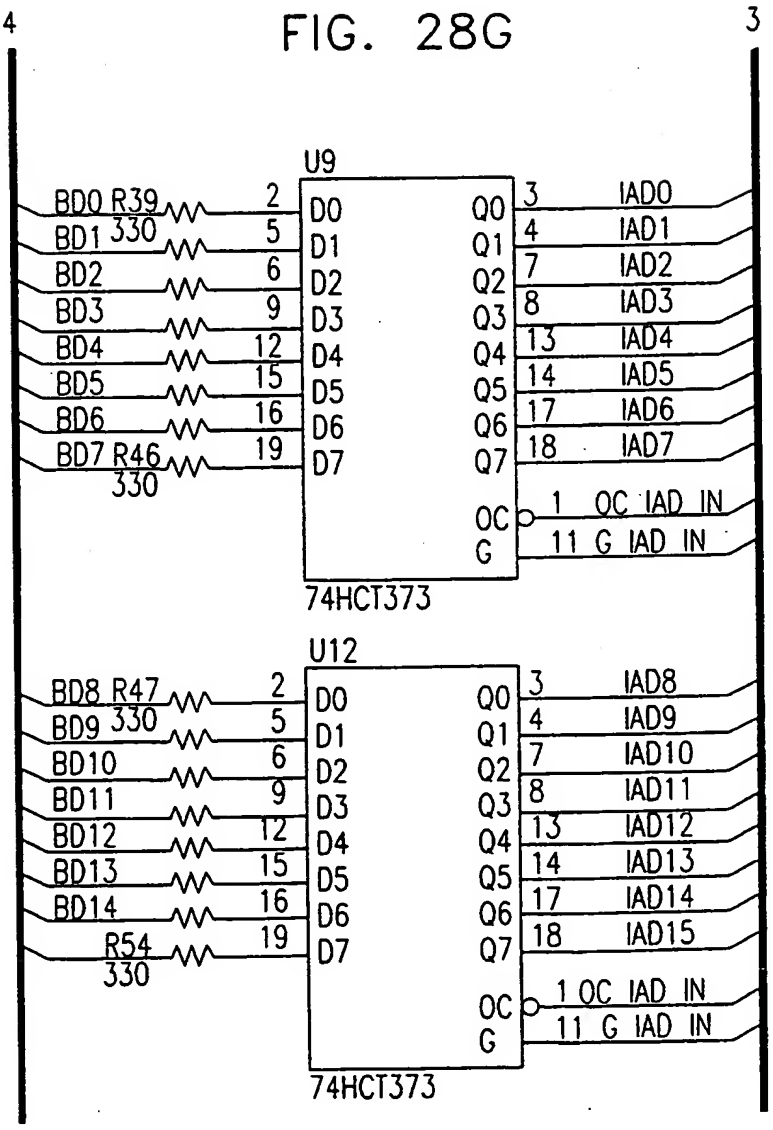

4
3
U9
BD0 R39
BD1 330
BD2
BD3
BD4
BD5
BD6
BD7 R46
330
2
5
6
9
12
15
16
19
D0
D1
D2
D3
D4
D5
D6
D7
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
OC
G
3
4
7
8
13
14
17
18
1
11
IAD0
IAD1
IAD2
IAD3
IAD4
IAD5
IAD6
IAD7
OC IAD IN
G IAD IN
74HCT373
U12
BD8 R47
BD9 330
BD10
BD11
BD12
BD13
BD14
R54
330
IAD8
IAD9
IAD10
IAD11
IAD12
IAD13
IAD14
IAD15
74HCT373

FIG. 28H

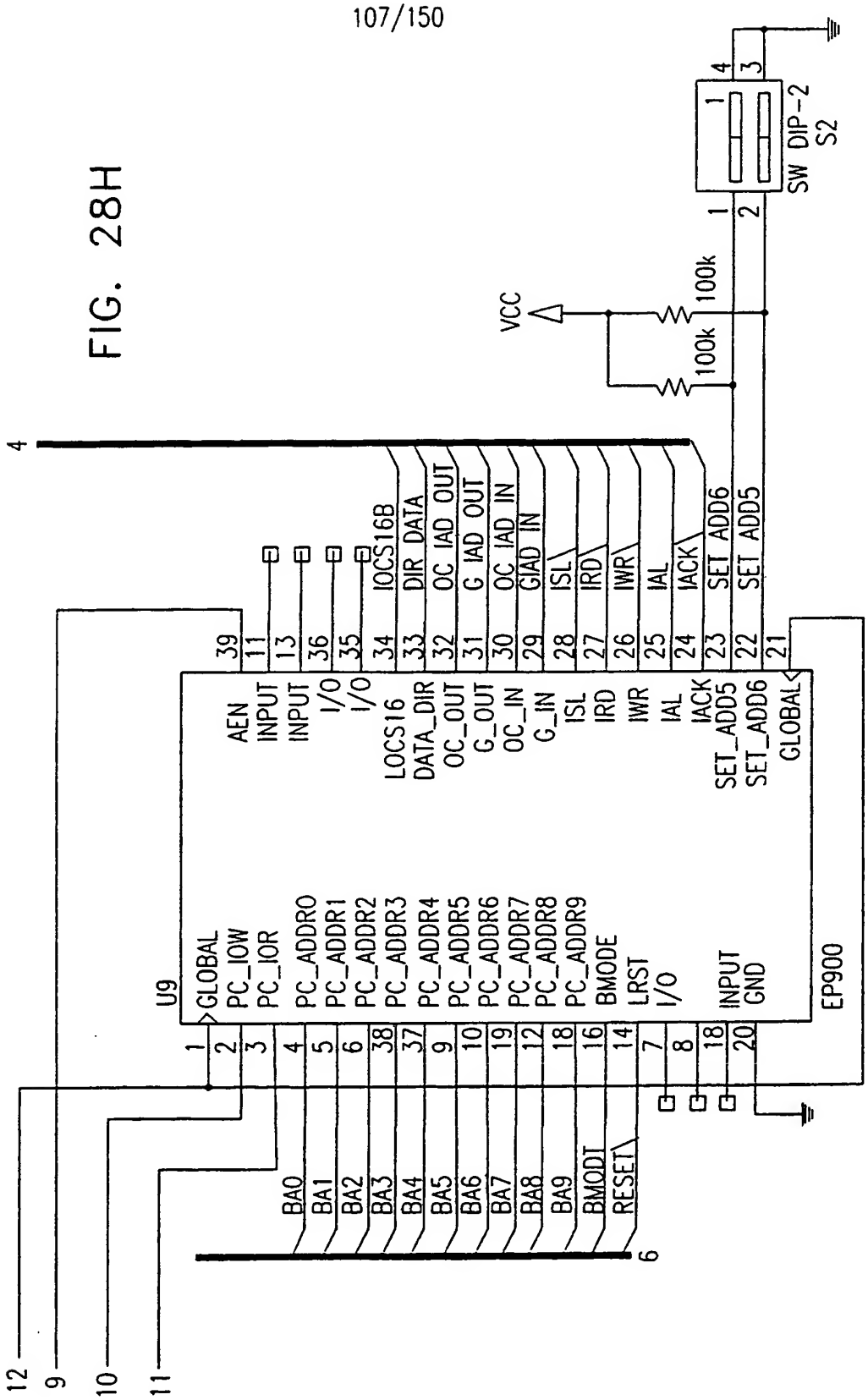
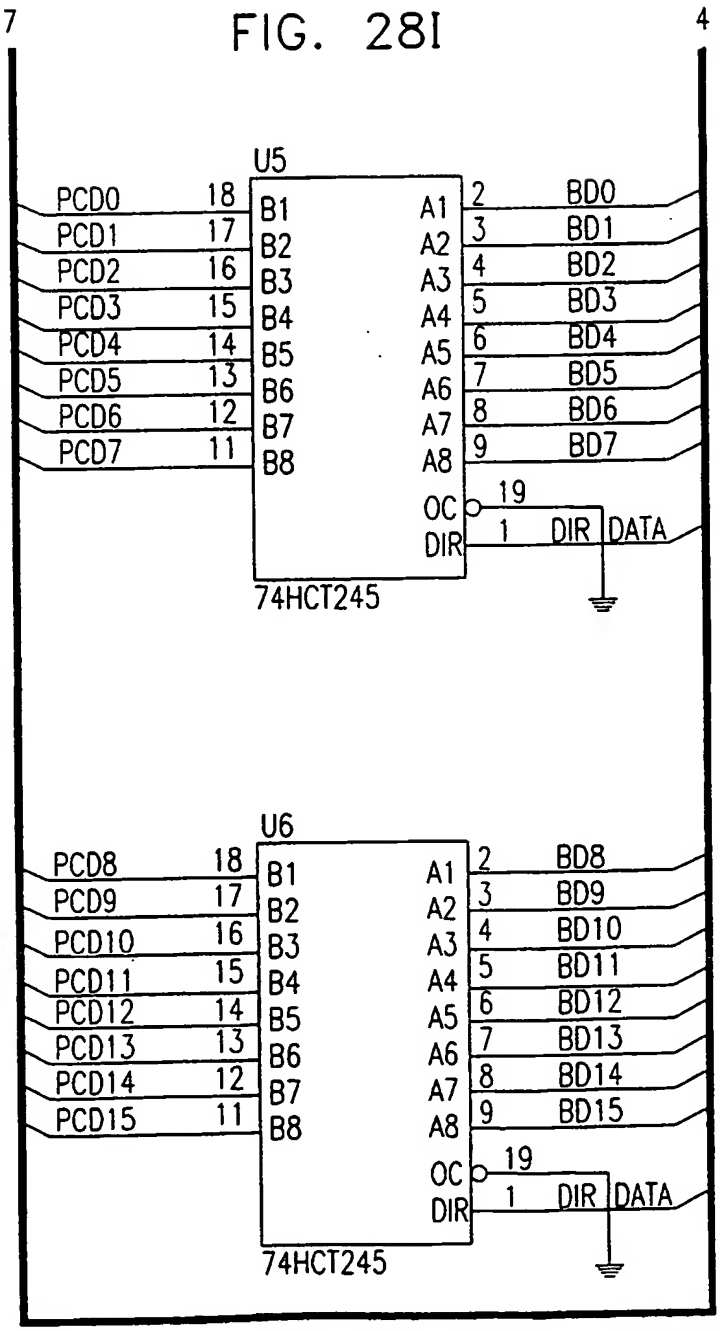

U9
EP900
GLOBAL
PC_IOW
PC_IOR
PC_ADDR0
PC_ADDR1
PC_ADDR2
PC_ADDR3
PC_ADDR4
PC_ADDR5
PC_ADDR6
PC_ADDR7
PC_ADDR8
PC_ADDR9
BMODE
LRST
I/O
INPUT
GND
BA0
BA1
BA2
BA3
BA4
BA5
BA6
BA7
BA8
BA9
BMODT
RESET
AEN
INPUT
INPUT
I/O
I/O
LOCS16
DATA_DIR
OC_OUT
G_OUT
OC_IN
G_IN
ISL
IRD
IWR
IAL
IACK
SET_ADD5
SET_ADD6
GLOBAL
IOCS16B
DIR_DATA
OC IAD OUT
G IAD OUT
OC IAD IN
GIAD IN
ISL
IRD
IWR
IAL
IACK
SET ADD6
SET ADD5
VCC
100k
100k
SW DIP-2
S2

FIG. 28I


7
4
U5
PCD0 18 B1
PCD1 17 B2
PCD2 16 B3
PCD3 15 B4
PCD4 14 B5
PCD5 13 B6
PCD6 12 B7
PCD7 11 B8
A1 2 BD0
A2 3 BD1
A3 4 BD2
A4 5 BD3
A5 6 BD4
A6 7 BD5
A7 8 BD6
A8 9 BD7
OC 19
DIR 1 DIR DATA
74HCT245
U6
PCD8 18 B1
PCD9 17 B2
PCD10 16 B3
PCD11 15 B4
PCD12 14 B5
PCD13 13 B6
PCD14 12 B7
PCD15 11 B8
A1 2 BD8
A2 3 BD9
A3 4 BD10
A4 5 BD11
A5 6 BD12
A6 7 BD13
A7 8 BD14
A8 9 BD15
OC 19
DIR 1 DIR DATA
74HCT245

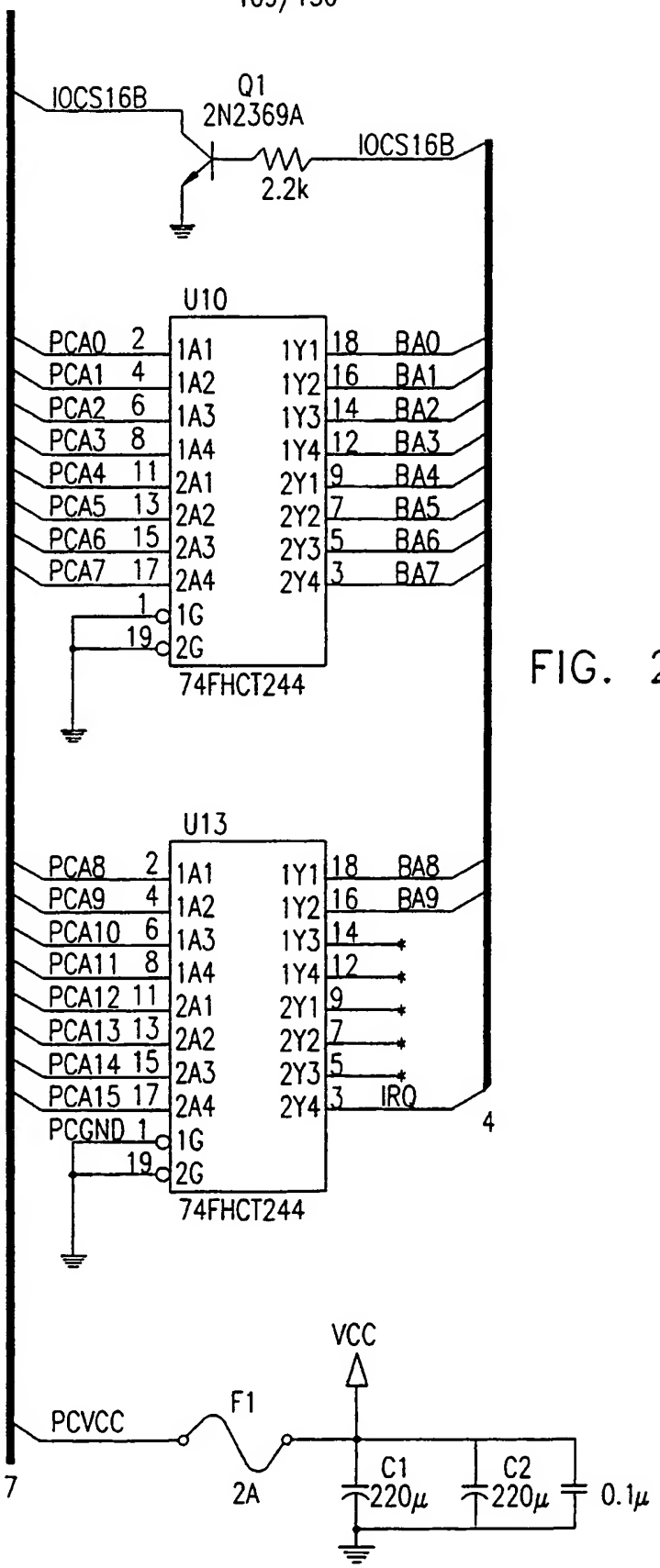

IOCS16B
Q1
2N2369A
IOCS16B
2.2k
U10
PCA0 2
PCA1 4
PCA2 6
PCA3 8
PCA4 11
PCA5 13
PCA6 15
PCA7 17
1
19
1A1
1A2
1A3
1A4
2A1
2A2
2A3
2A4
1G
2G
1Y1
1Y2
1Y3
1Y4
2Y1
2Y2
2Y3
2Y4
18 BA0
16 BA1
14 BA2
12 BA3
9 BA4
7 BA5
5 BA6
3 BA7
74FHCT244
U13
PCA8 2
PCA9 4
PCA10 6
PCA11 8
PCA12 11
PCA13 13
PCA14 15
PCA15 17
PCGND 1
19
18 BA8
16 BA9
14
12
9
7
5
3 IRQ
4
74FHCT244
VCC
PCVCC
F1
2A
C1
220µ
C2
220µ
0.1µ
7

FIG. 28J

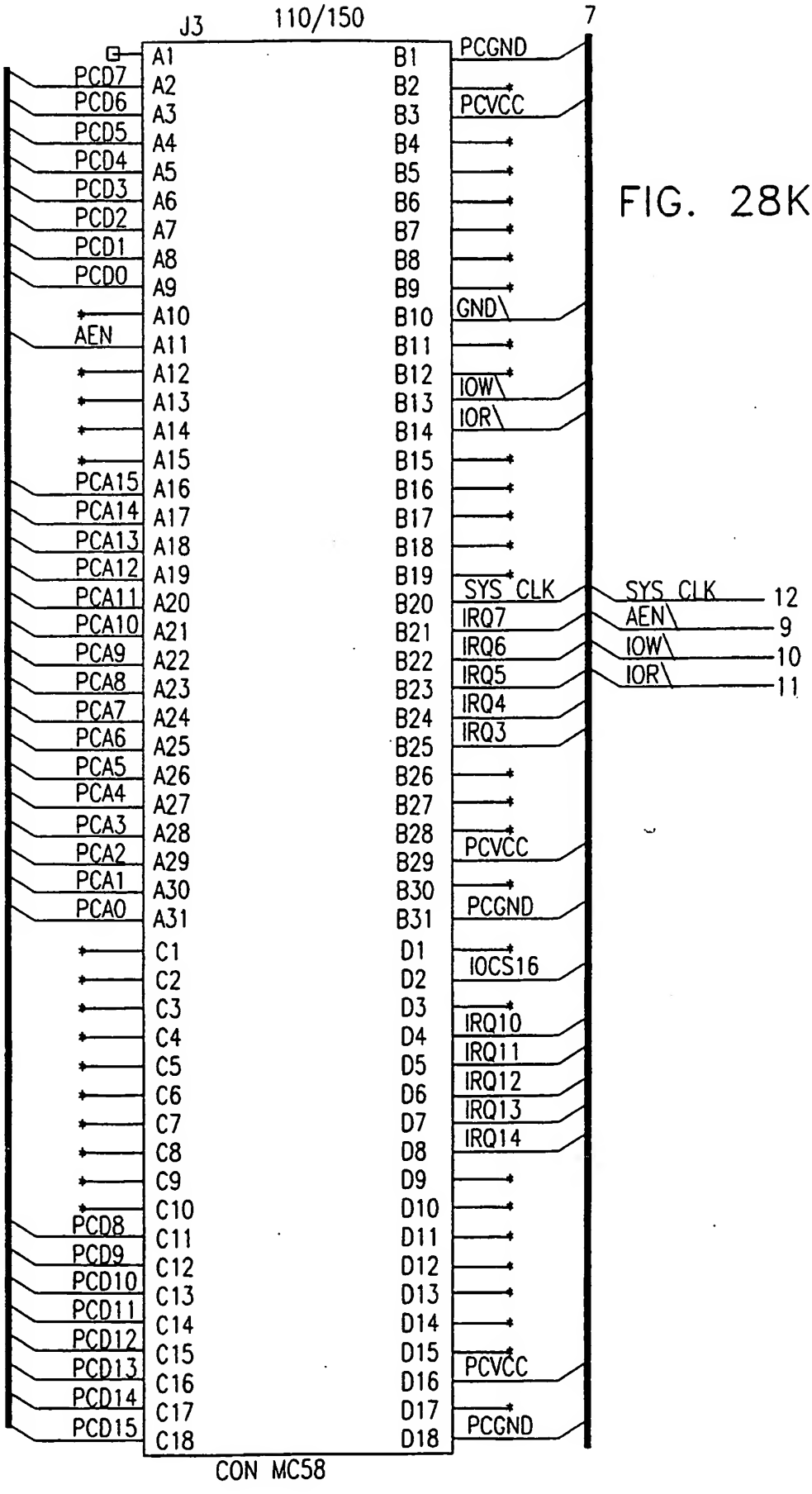

J3
110/150
7
A1
PCD7
PCD6
PCD5
PCD4
PCD3
PCD2
PCD1
PCD0
A10
AEN
PCA15
PCA14
PCA13
PCA12
PCA11
PCA10
PCA9
PCA8
PCA7
PCA6
PCA5
PCA4
PCA3
PCA2
PCA1
PCA0
PCD8
PCD9
PCD10
PCD11
PCD12
PCD13
PCD14
PCD15
B1
PCGND
PCVCC
GND\
IOW\
IOR\
SYS CLK
IRQ7
IRQ6
IRQ5
IRQ4
IRQ3
PCVCC
PCGND
IOCS16
IRQ10
IRQ11
IRQ12
IRQ13
IRQ14
PCVCC
PCGND
SYS CLK 12
AEN\ 9
IOW\ 10
IOR\ 11
CON MC58

FIG. 28K

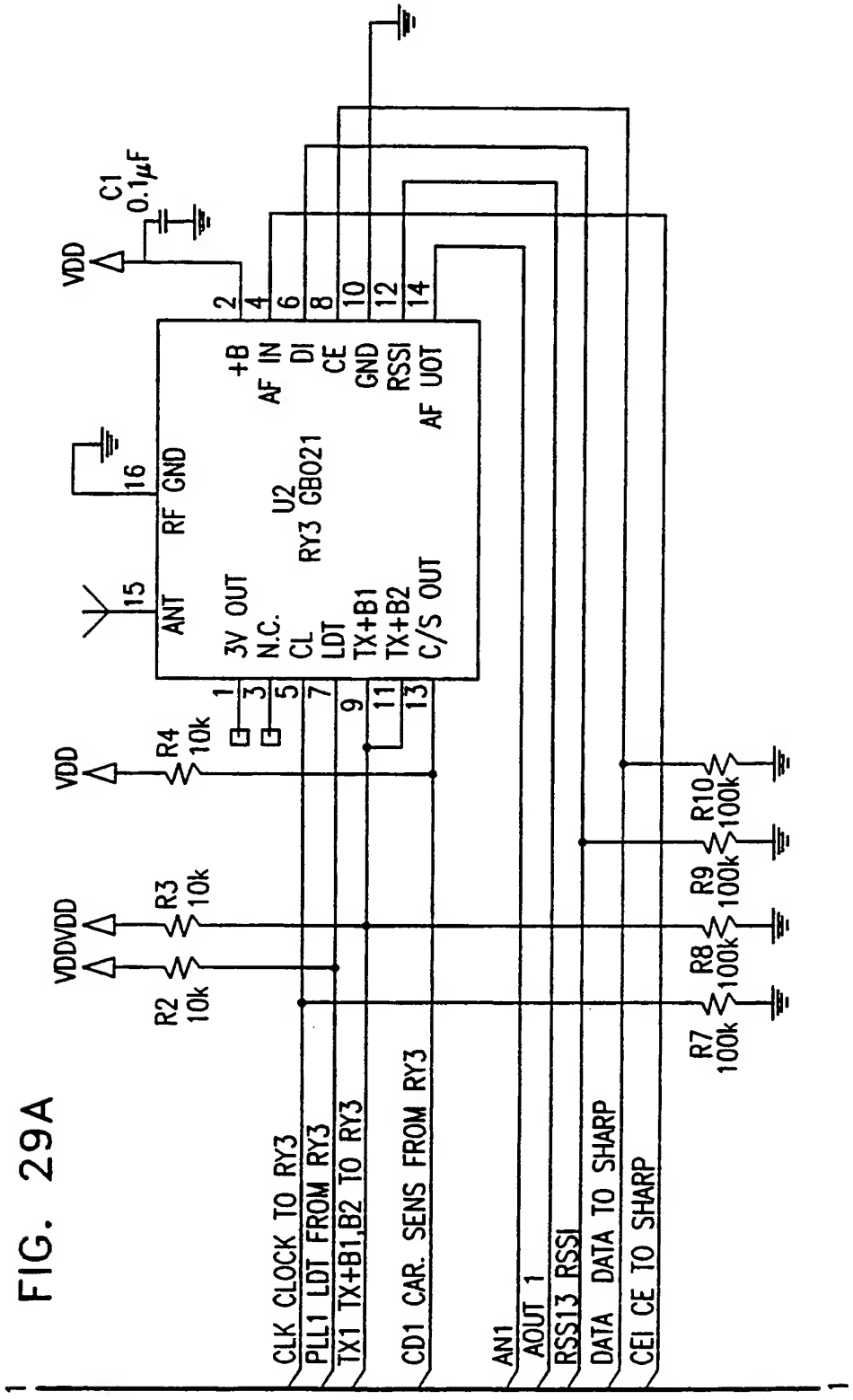

C1
0.1μF
VDD
2
4
6
8
10
12
14
+B
AF IN
DI
CE
GND
RSSI
AF UOT
U2
RY3 GB021
16
RF GND
15
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
1
3
5
7
9
11
13
R4
10k
VDD
R3
10k
VDDVDD
R2
10k
R10
100k
R9
100k
R8
100k
R7
100k
CLK CLOCK TO RY3
PLL1 LDT FROM RY3
TX1 TX+B1,B2 TO RY3
CD1 CAR. SENS FROM RY3
AN1
AOUT 1
RSS13 RSSI
DATA DATA TO SHARP
CEI CE TO SHARP

FIG. 29A

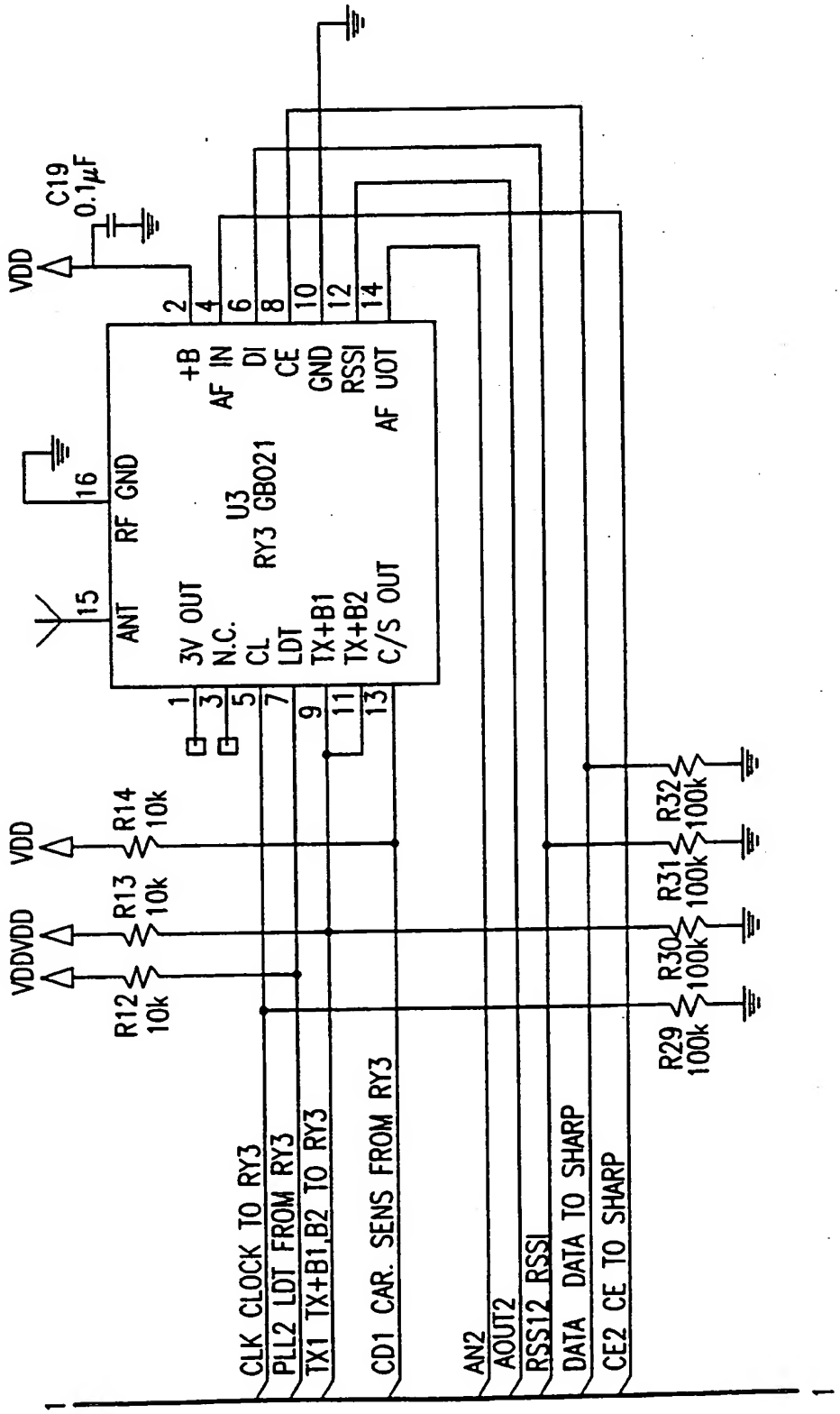

C19
0.1µF
VDD
U3
RY3 GB021
RF GND
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
+B
AF IN
DI
CE
GND
RSSI
AF UOT
R14
10k
R13
10k
R12
10k
VDDVDD
R32
100k
R31
100k
R30
100k
R29
100k
CLK CLOCK TO RY3
PLL2 LDT FROM RY3
TX1 TX+B1,B2 TO RY3
CD1 CAR. SENS FROM RY3
AN2
AOUT2
RSS12 RSSI
DATA DATA TO SHARP
CE2 CE TO SHARP

FIG. 29B

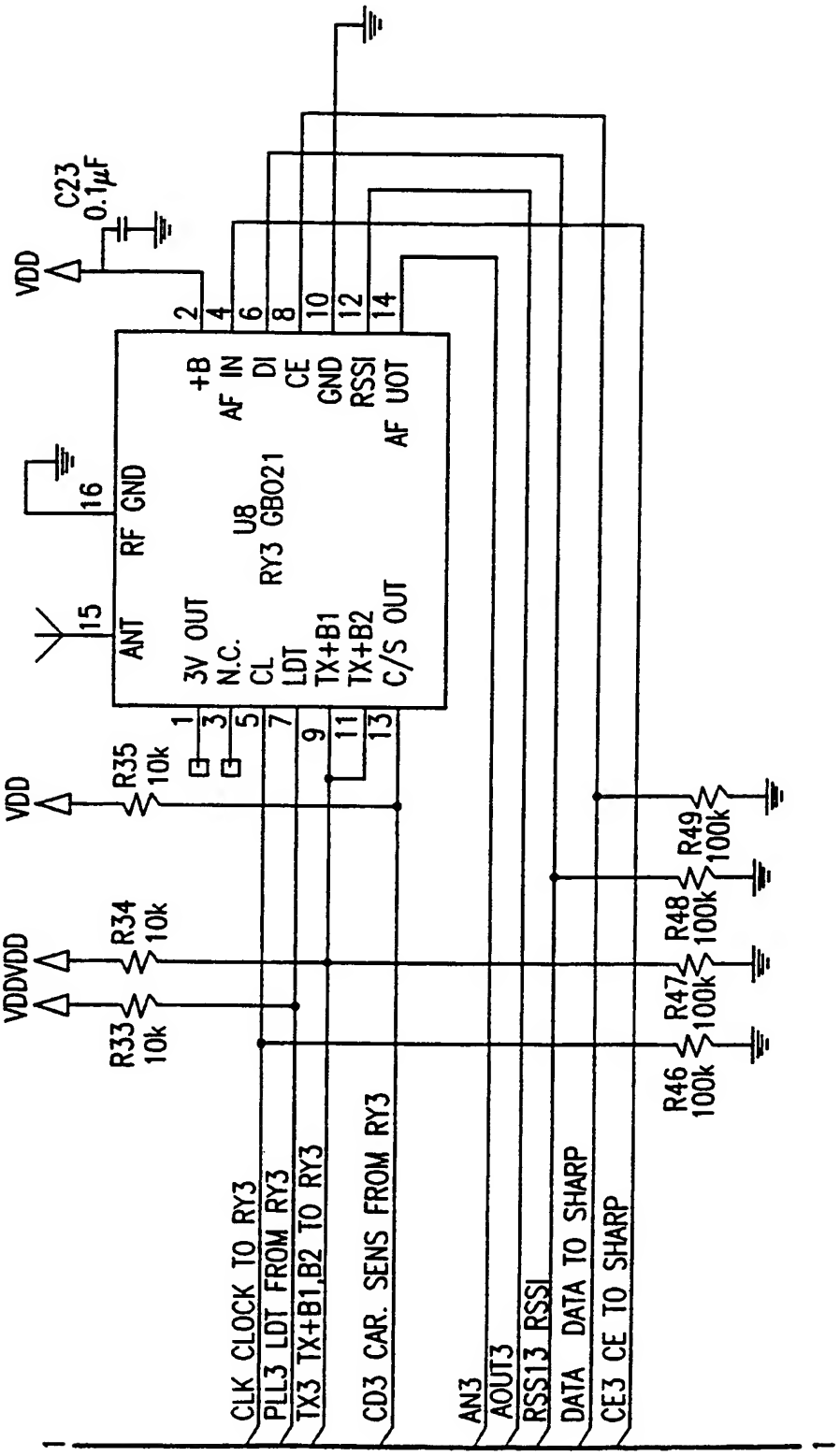

C23
0.1µF
VDD
U8
GB021
RY3
RF GND
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
+B
AF IN
DI
CE
GND
RSSI
AF UOT
R35
10k
R34
10k
R33
10k
VDDVDD
R49
100k
R48
100k
R47
100k
R46
100k
CLK CLOCK TO RY3
PLL3 LDT FROM RY3
TX3 TX+B1,B2 TO RY3
CD3 CAR. SENS FROM RY3
AN3
AOUT3
RSS13 RSSI
DATA DATA TO SHARP
CE3 CE TO SHARP

FIG. 29C

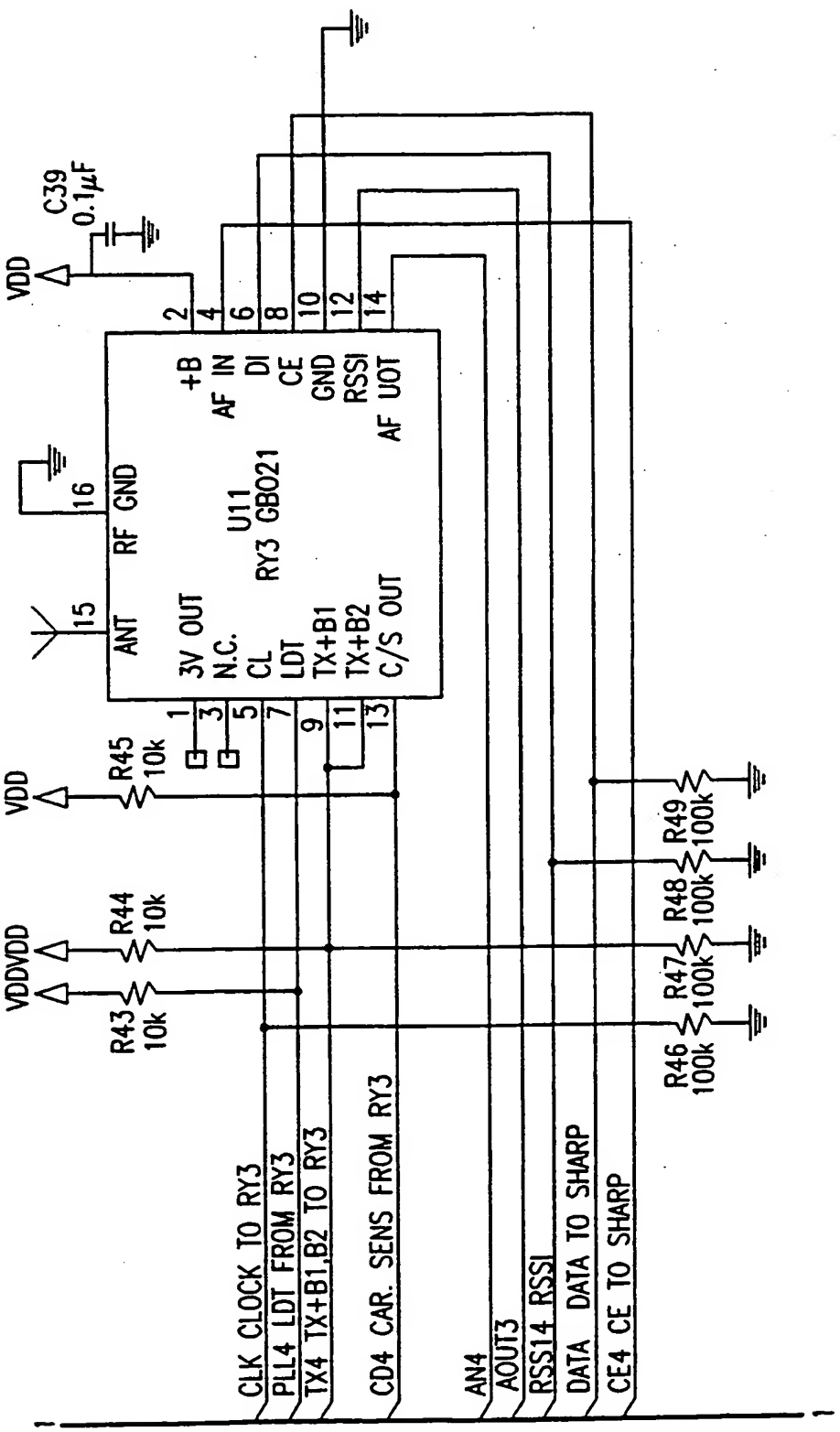

C39
0.1µF
VDD
U11
RY3 GB021
ANT
RF GND
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
+B
AF IN
DI
CE
GND
RSSI
AF UOT
R45
10k
R44
10k
R43
10k
VDDVDD
R49
100k
R48
100k
R47
100k
R46
100k
CLK CLOCK TO RY3
PLL4 LDT FROM RY3
TX4 TX+B1,B2 TO RY3
CD4 CAR. SENS FROM RY3
AN4
AOUT3
RSS14 RSSI
DATA DATA TO SHARP
CE4 CE TO SHARP

FIG. 29D

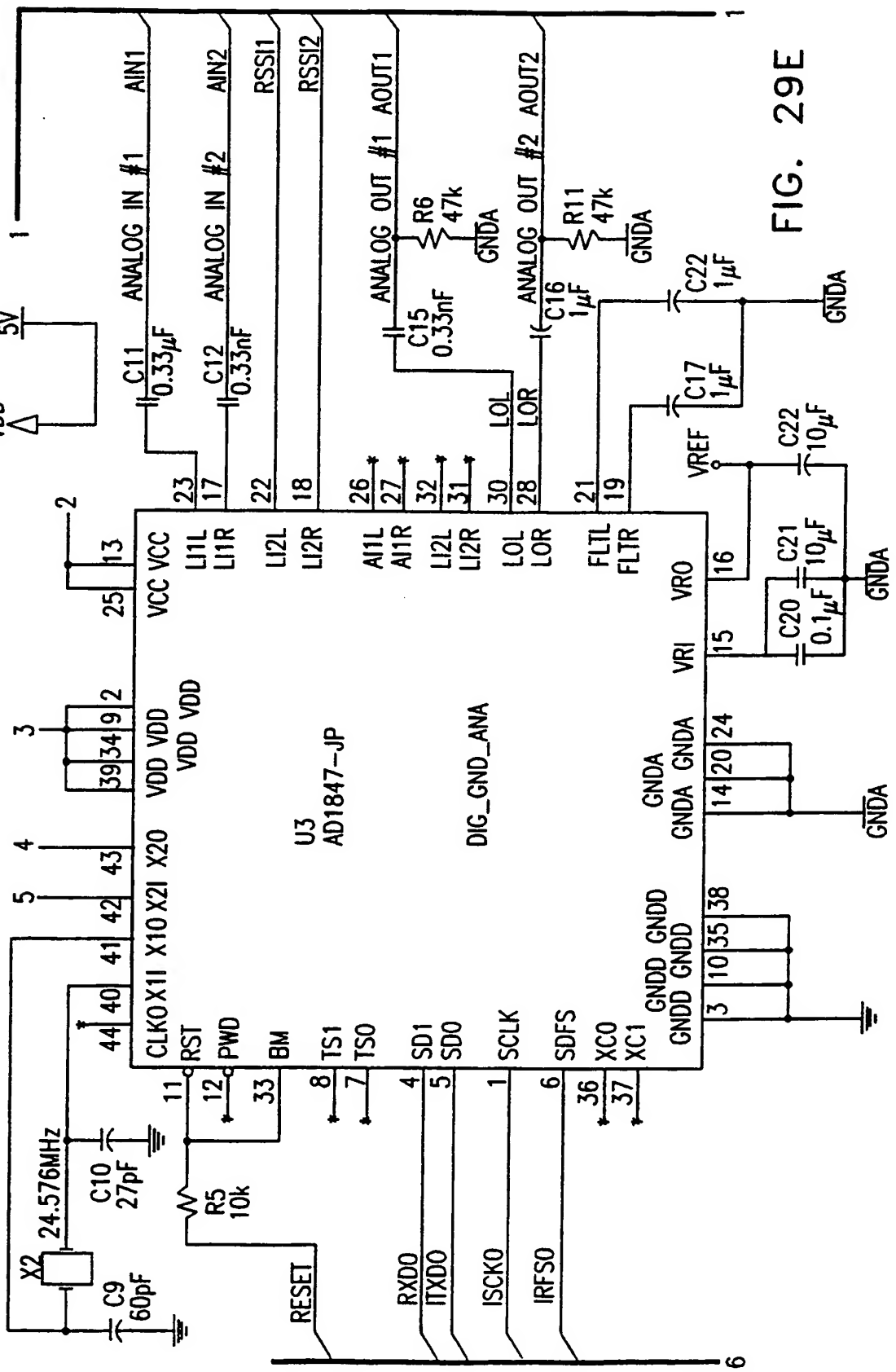

U3
AD1847-JP
DIG_GND_ANA
VDD
5V
ANALOG IN #1
ANALOG IN #2
ANALOG OUT #1
ANALOG OUT #2
AIN1
AIN2
AOUT1
AOUT2
RSSI1
RSSI2
C11 0.33µF
C12 0.33nF
C15 0.33nF
C16 1µF
C17 1µF
C22 1µF
C22 10µF
C21 10µF
C20 0.1µF
R6 47k
R11 47k
GNDA
VREF
X2 24.576MHz
C9 60pF
C10 27pF
R5 10k
RESET
RXDO
ITXDO
ISCKO
IRFSO
VCC
VDD
GNDD
CLKO X11 X10 X2I X20
RST PWD BM TS1 TS0 SD1 SD0 SCLK SDFS XC0 XC1
LI1L LI1R LI2L LI2R AI1L AI1R LI2L LI2R LOL LOR FLTL FLTR
VRO VRI
GNDA GNDA
GNDD GNDD

FIG. 29E

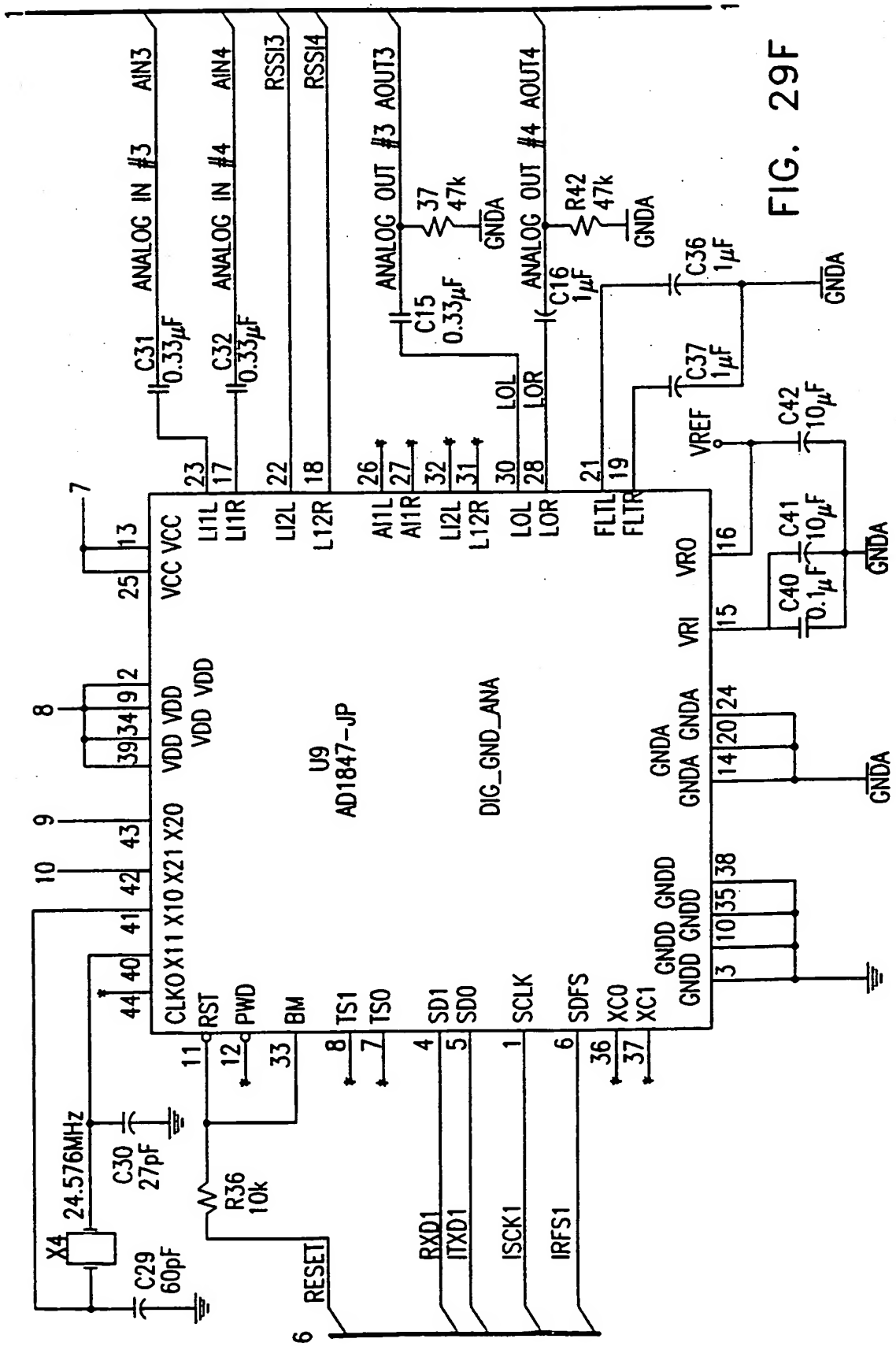

U9
AD1847-JP
DIG_GND_ANA
VCC VCC
VDD VDD
VDD VDD
CLKO X11 X10 X21 X20
RST
PWD
BM
TS1
TSO
SD1
SDO
SCLK
SDFS
XC0
XC1
GNDD GNDD
GNDD GNDD
GNDA GNDA
GNDA GNDA
VRI
VRO
VREF
FLTL
FLTR
LI1L
LI1R
LI2L
L12R
AI1L
AI1R
LI2L
L12R
LOL
LOR
AIN3
AIN4
RSSI3
RSSI4
ANALOG IN #3
ANALOG IN #4
ANALOG OUT #3
ANALOG OUT #4
AOUT3
AOUT4
C31 0.33µF
C32 0.33µF
C15 0.33µF
C16 1µF
C36 1µF
C37 1µF
C42 10µF
C41 10µF
C40 0.1µF
R37 47k
R42 47k
GNDA
X4 24.576MHz
C30 27pF
C29 60pF
R36 10k
RESET
RXD1
ITXD1
ISCK1
IRFS1

FIG. 29F

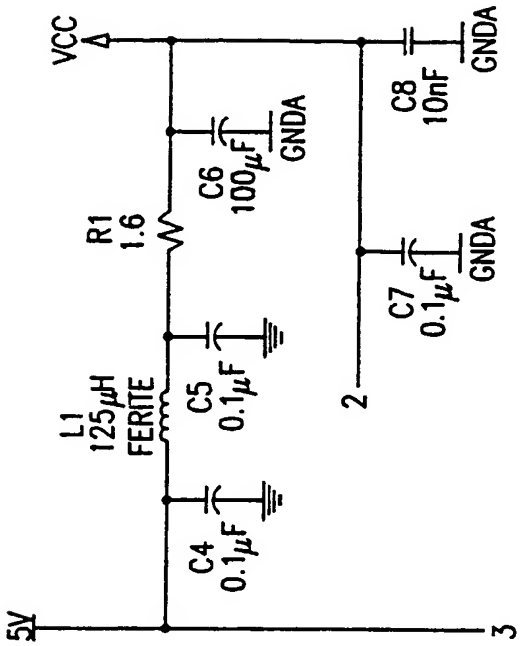
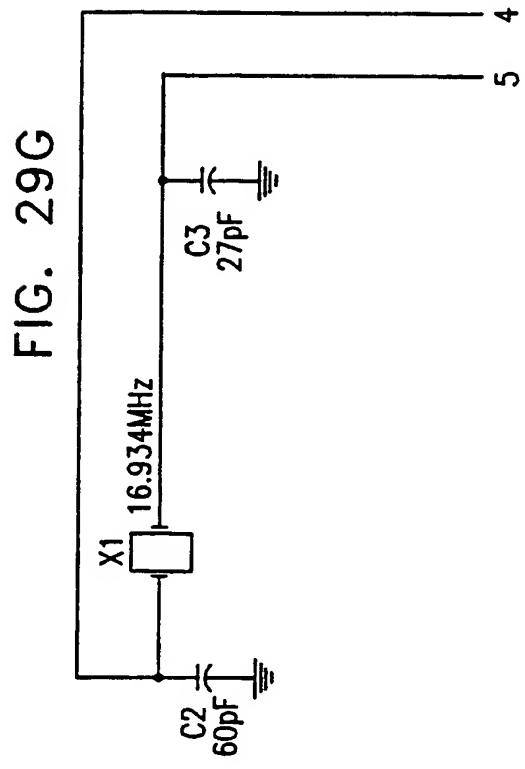


FIG. 29G



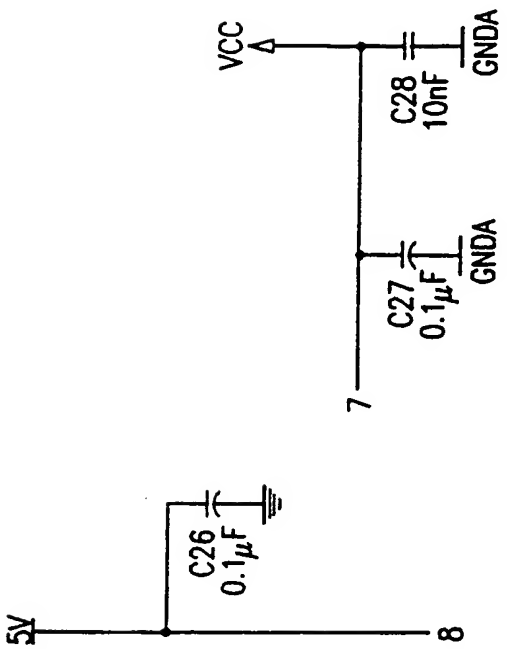
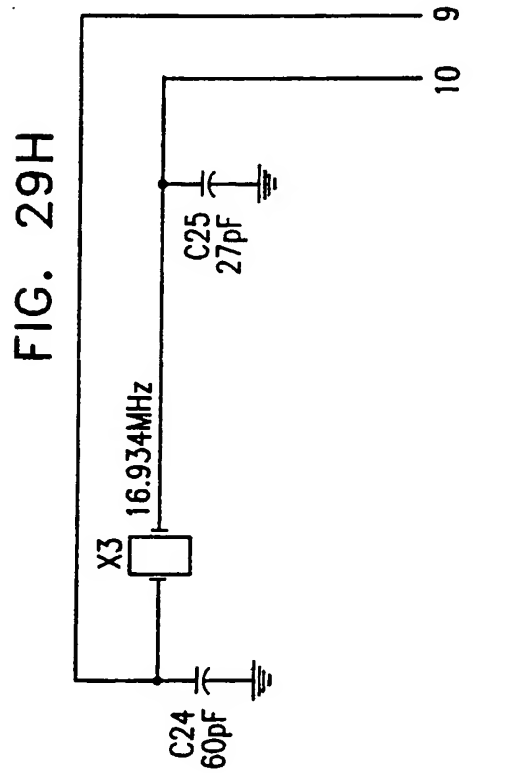


FIG. 29H



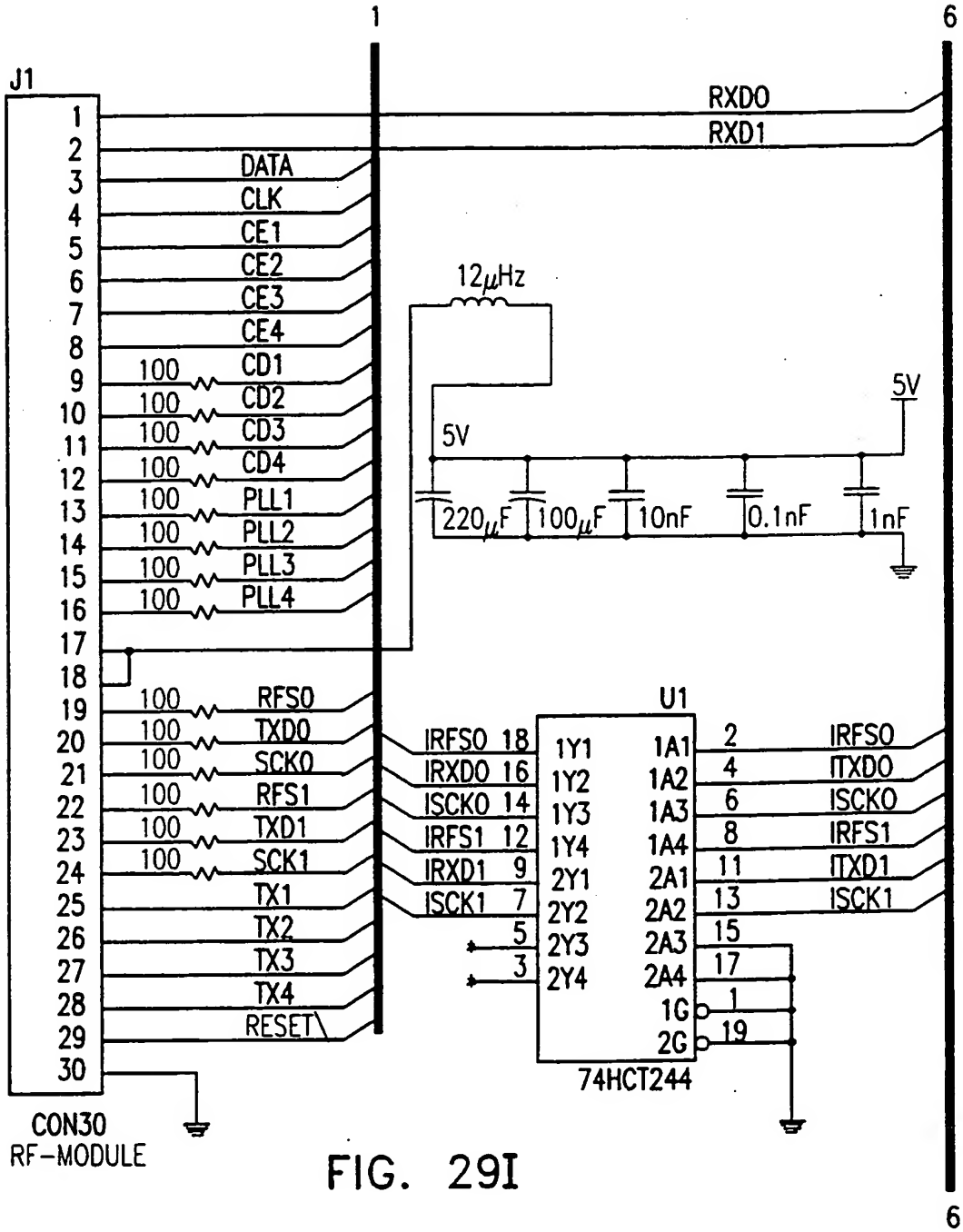

1
6
J1
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
RXD0
RXD1
DATA
CLK
CE1
CE2
CE3
CE4
100 CD1
100 CD2
100 CD3
100 CD4
100 PLL1
100 PLL2
100 PLL3
100 PLL4
100 RFS0
100 TXD0
100 SCK0
100 RFS1
100 TXD1
100 SCK1
TX1
TX2
TX3
TX4
RESET\
12μHz
5V
5V
220μF
100μF
10nF
0.1nF
1nF
U1
IRFS0 18
IRXD0 16
ISCK0 14
IRFS1 12
IRXD1 9
ISCK1 7
5
3
1Y1
1Y2
1Y3
1Y4
2Y1
2Y2
2Y3
2Y4
1A1
1A2
1A3
1A4
2A1
2A2
2A3
2A4
1G
2G
2
4
6
8
11
13
15
17
1
19
IRFS0
ITXD0
ISCK0
IRFS1
ITXD1
ISCK1
74HCT244
CON30
RF-MODULE
6

FIG. 29I

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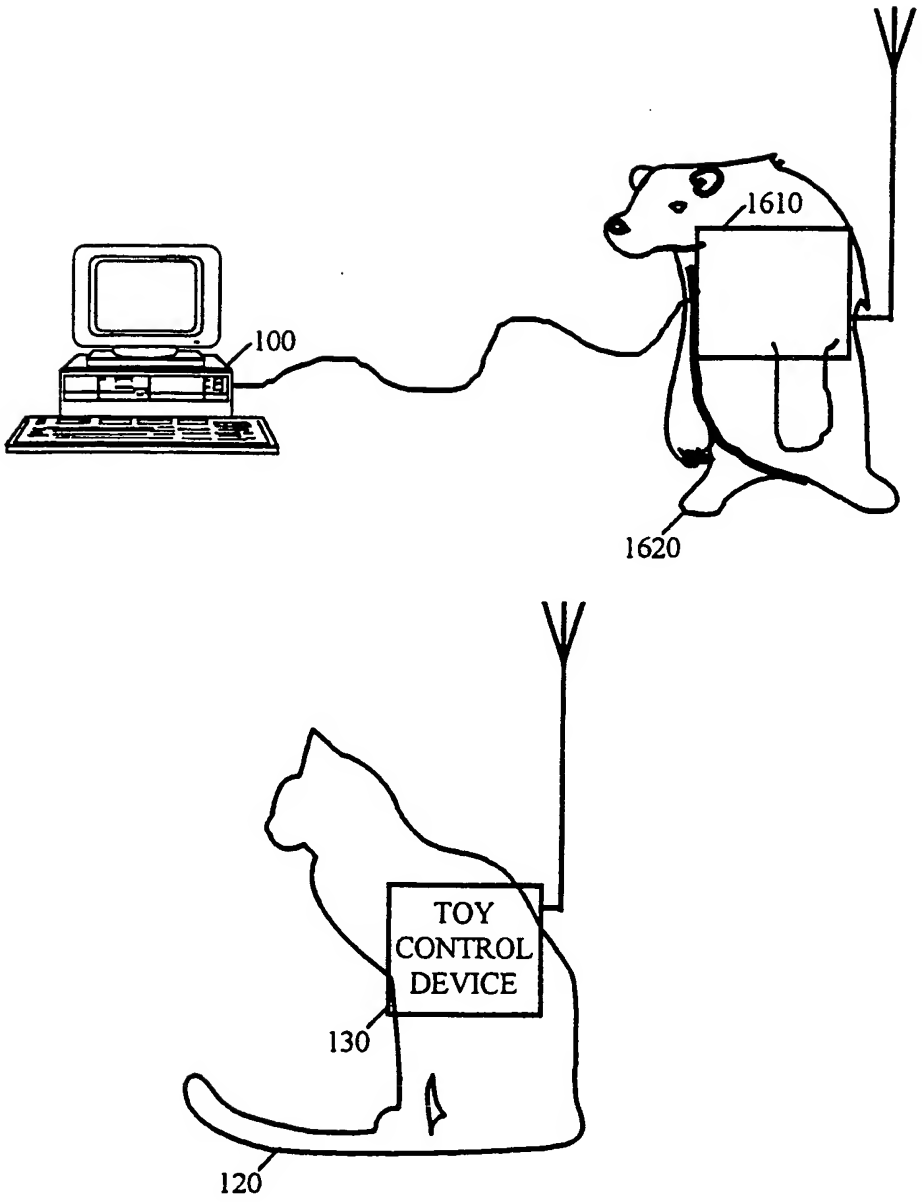
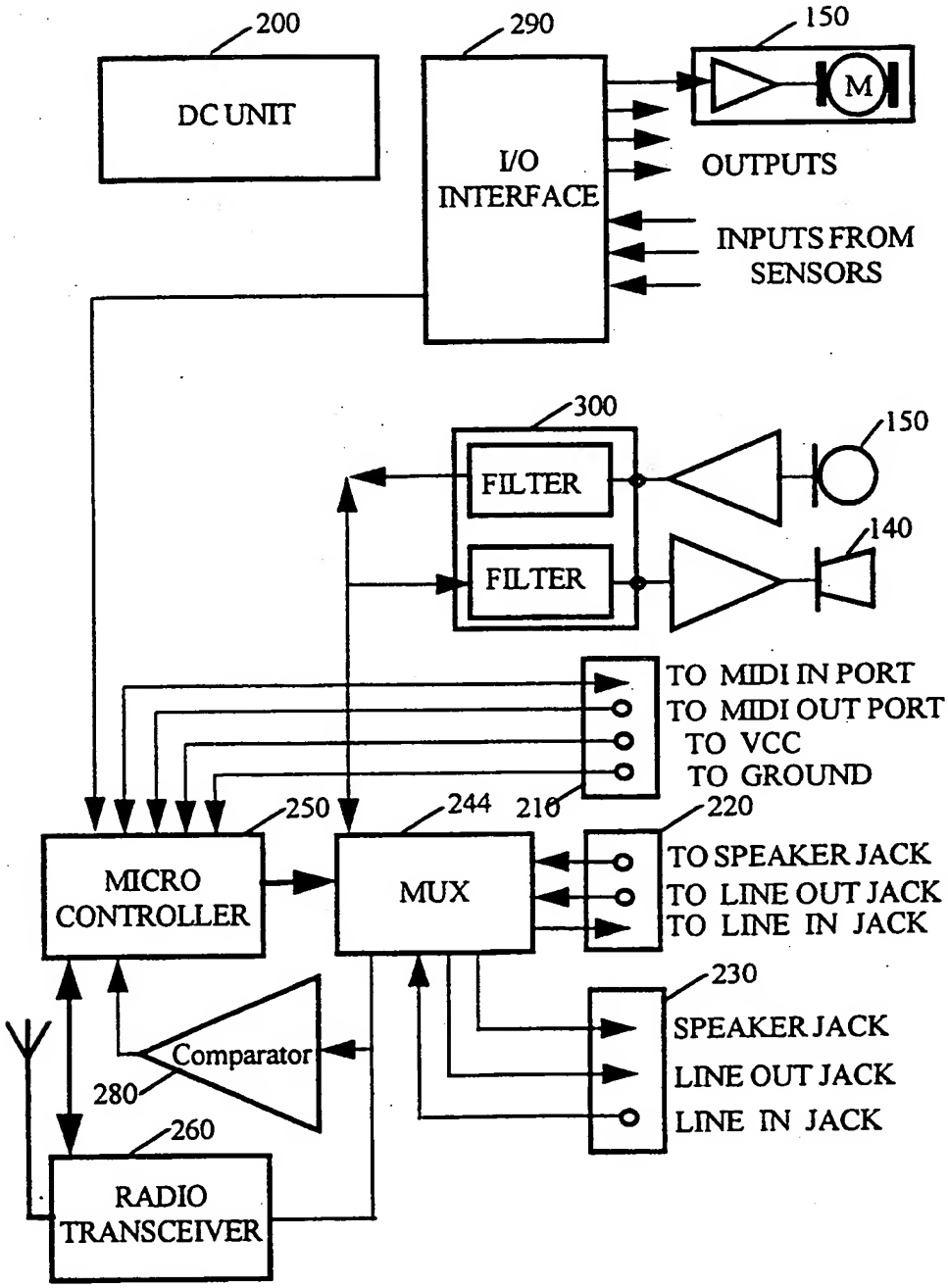
FIGURE 30



120 /150
FIGURE 31



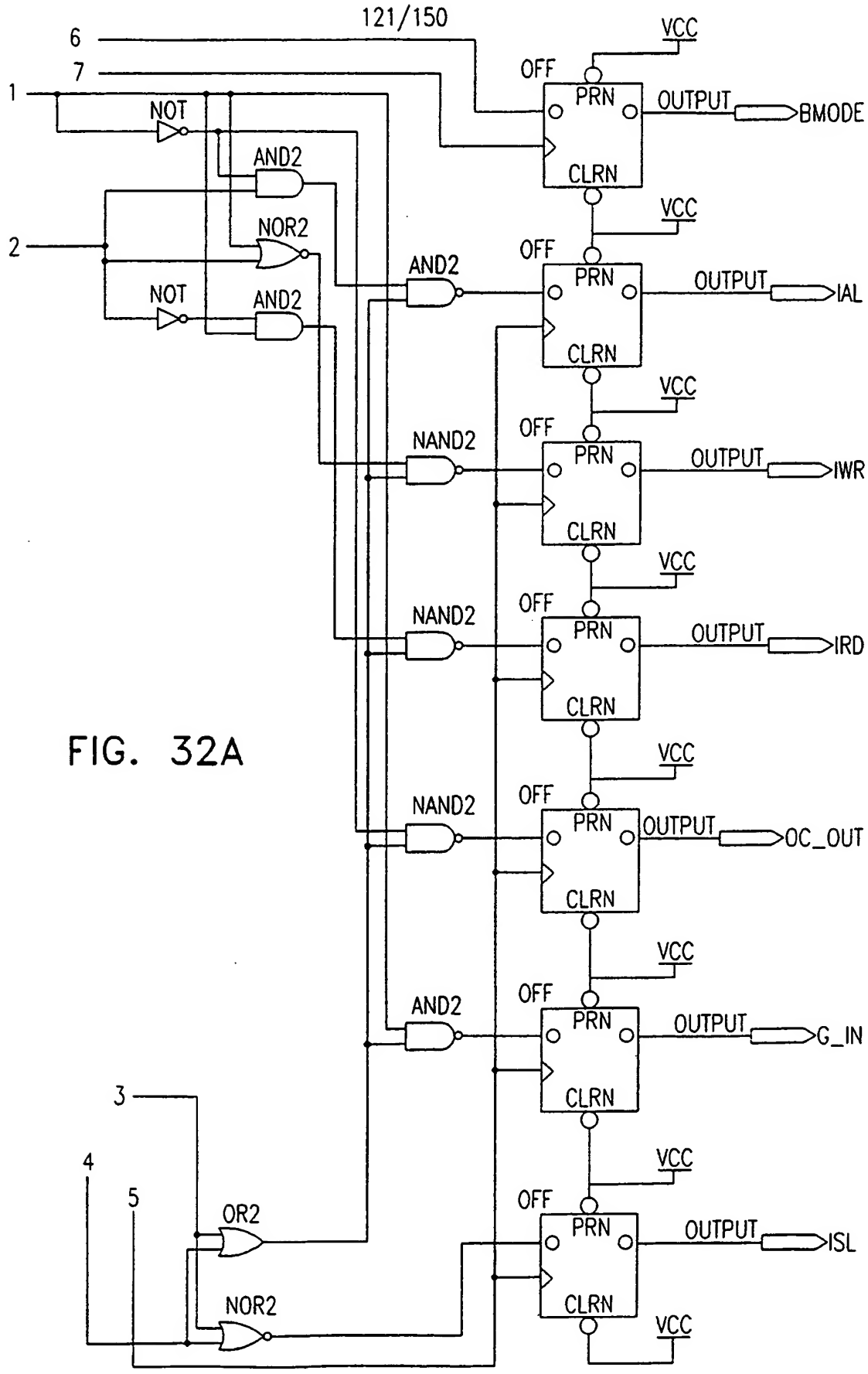

121/150
6
7
1
2
3
4
5
NOT
AND2
NOR2
NOT
AND2
OR2
NOR2
VCC
OFF
PRN
CLRN
OUTPUT
BMODE
AND2
IAL
NAND2
IWR
NAND2
IRD
NAND2
OC_OUT
AND2
G_IN
ISL

FIG. 32A

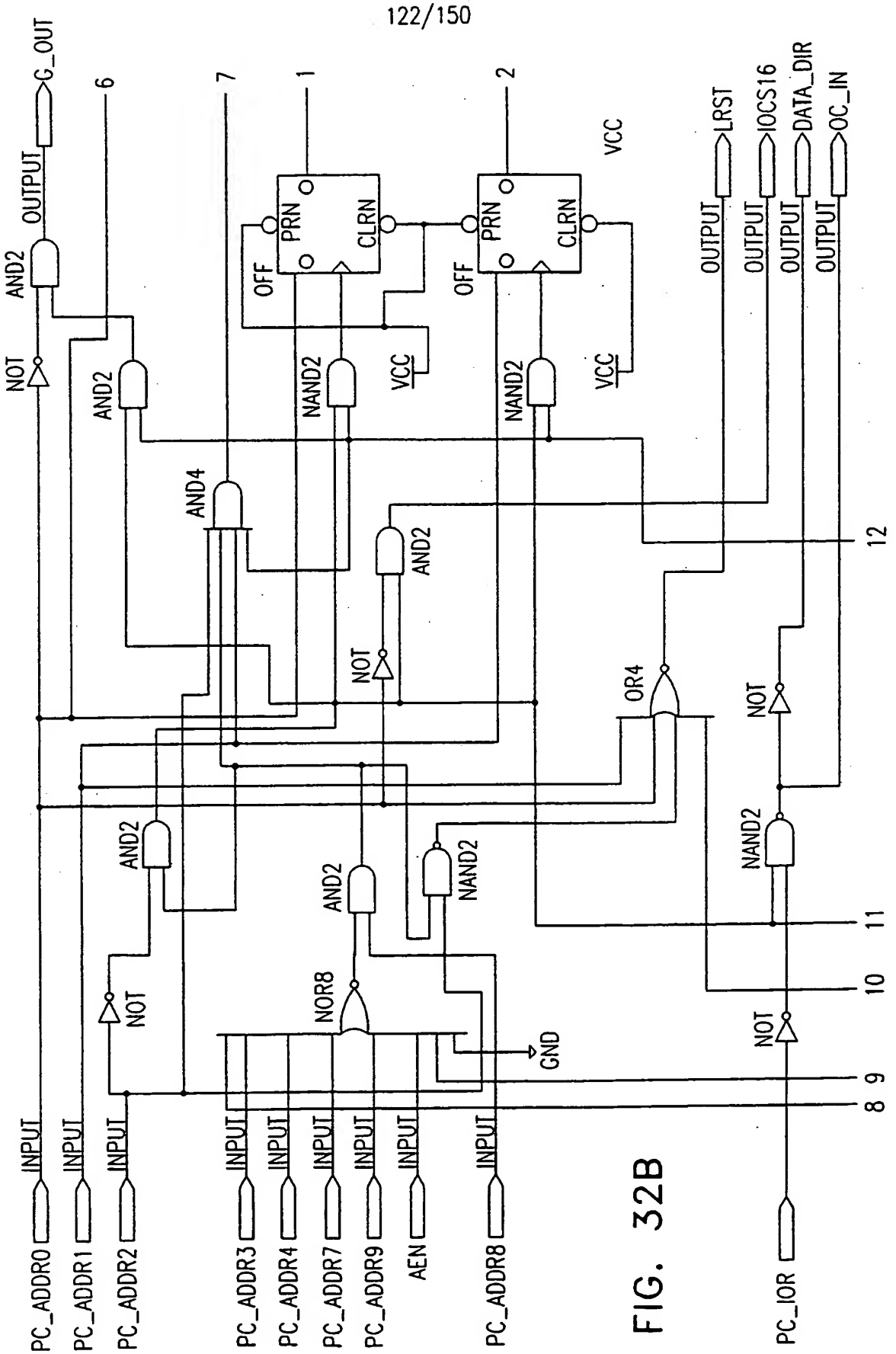
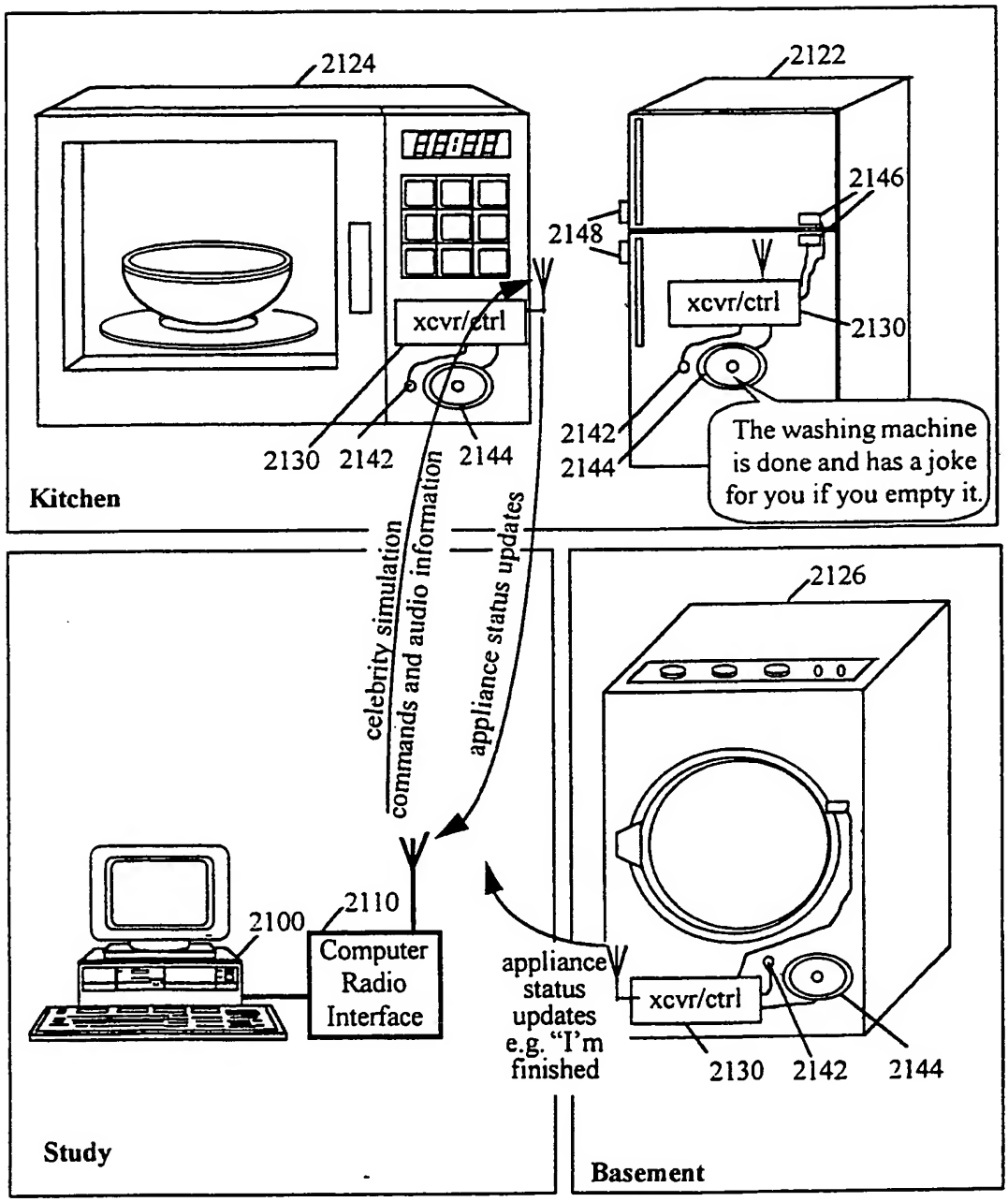
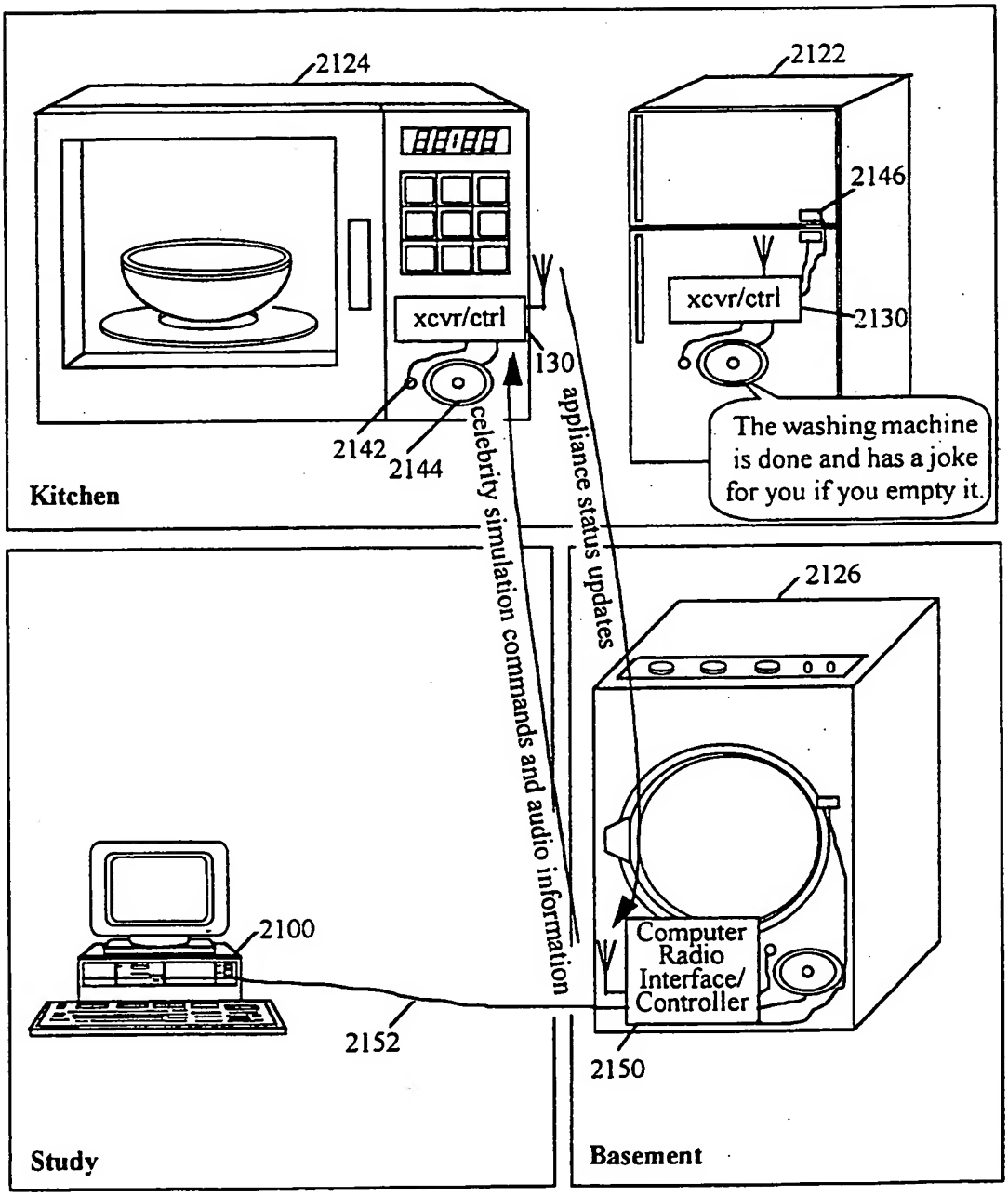

G_OUT
OUTPUT
AND2
NOT
6
7
1
2
PRN
CLRN
OFF
VCC
NAND2
AND4
AND2
NOT
OR4
LRST
IOCS16
DATA_DIR
OC_IN
12
11
10
9
8
NOR8
GND
INPUT
PC_ADDR0
PC_ADDR1
PC_ADDR2
PC_ADDR3
PC_ADDR4
PC_ADDR7
PC_ADDR9
AEN
PC_ADDR8
PC_IOR

FIG. 32B

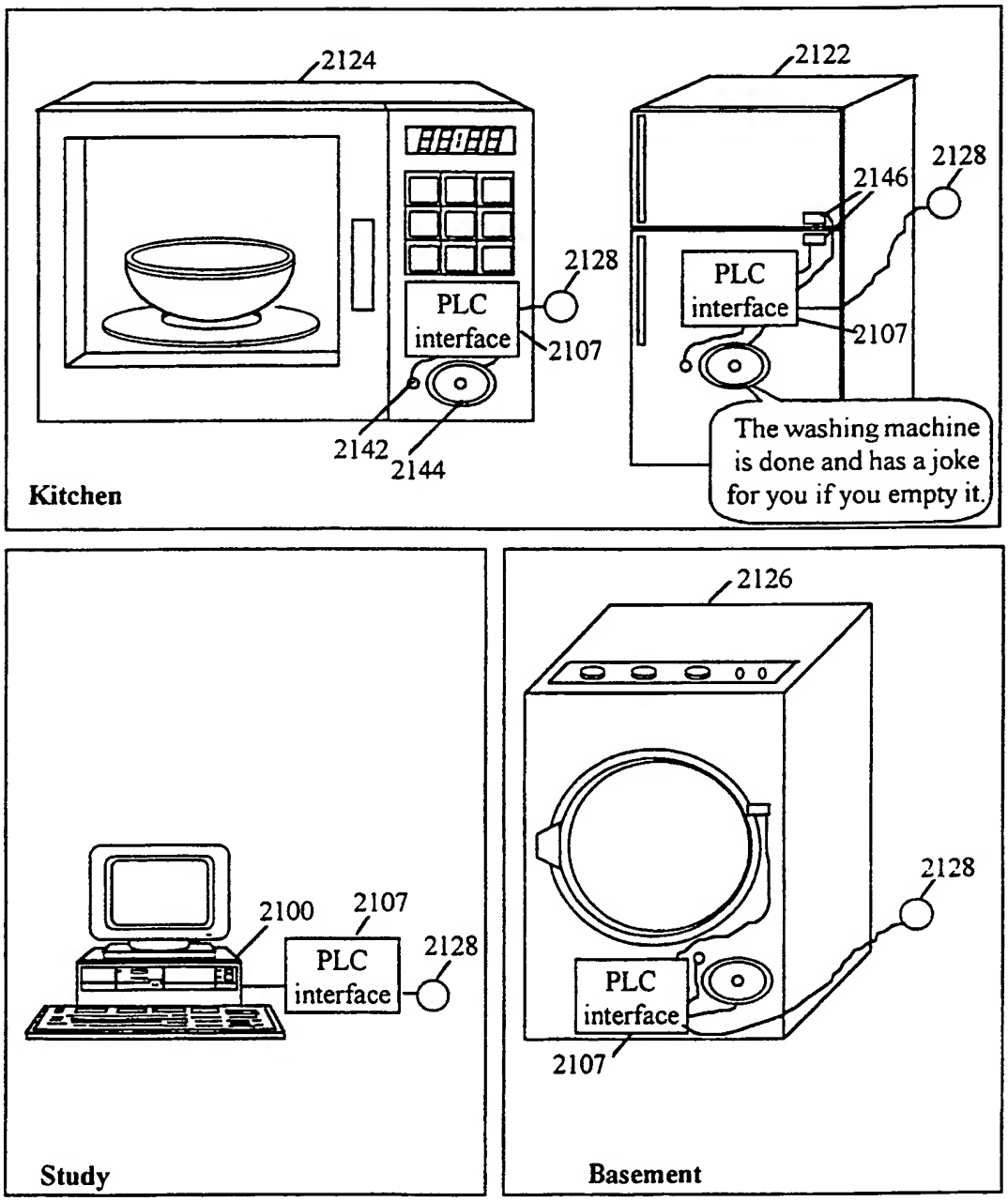
123 /150
FIGURE 33



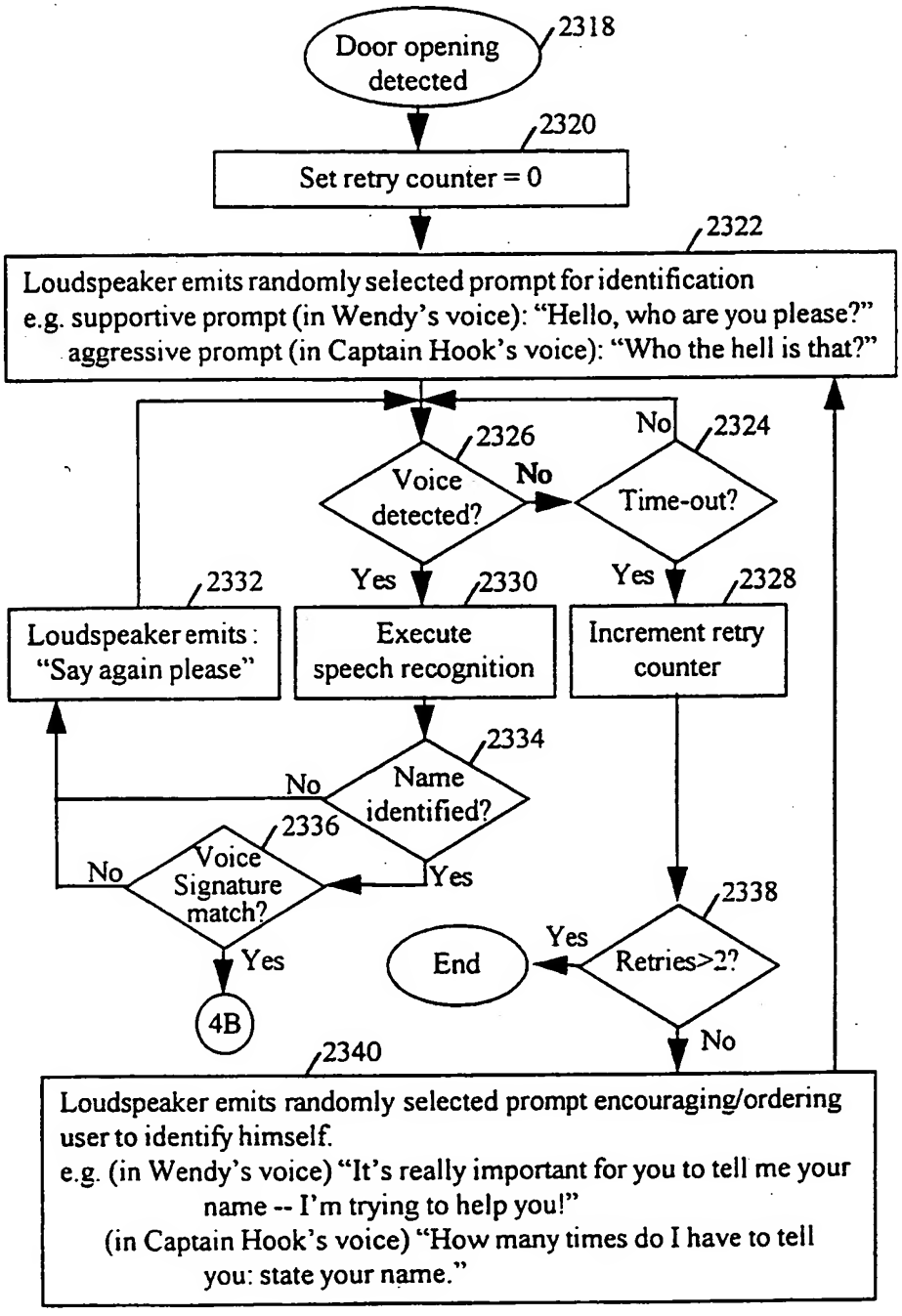
124 /150
FIGURE 34



125 /150
FIGURE 35



126 /150
FIGURE 36A



127 /150

FIGURE 36B

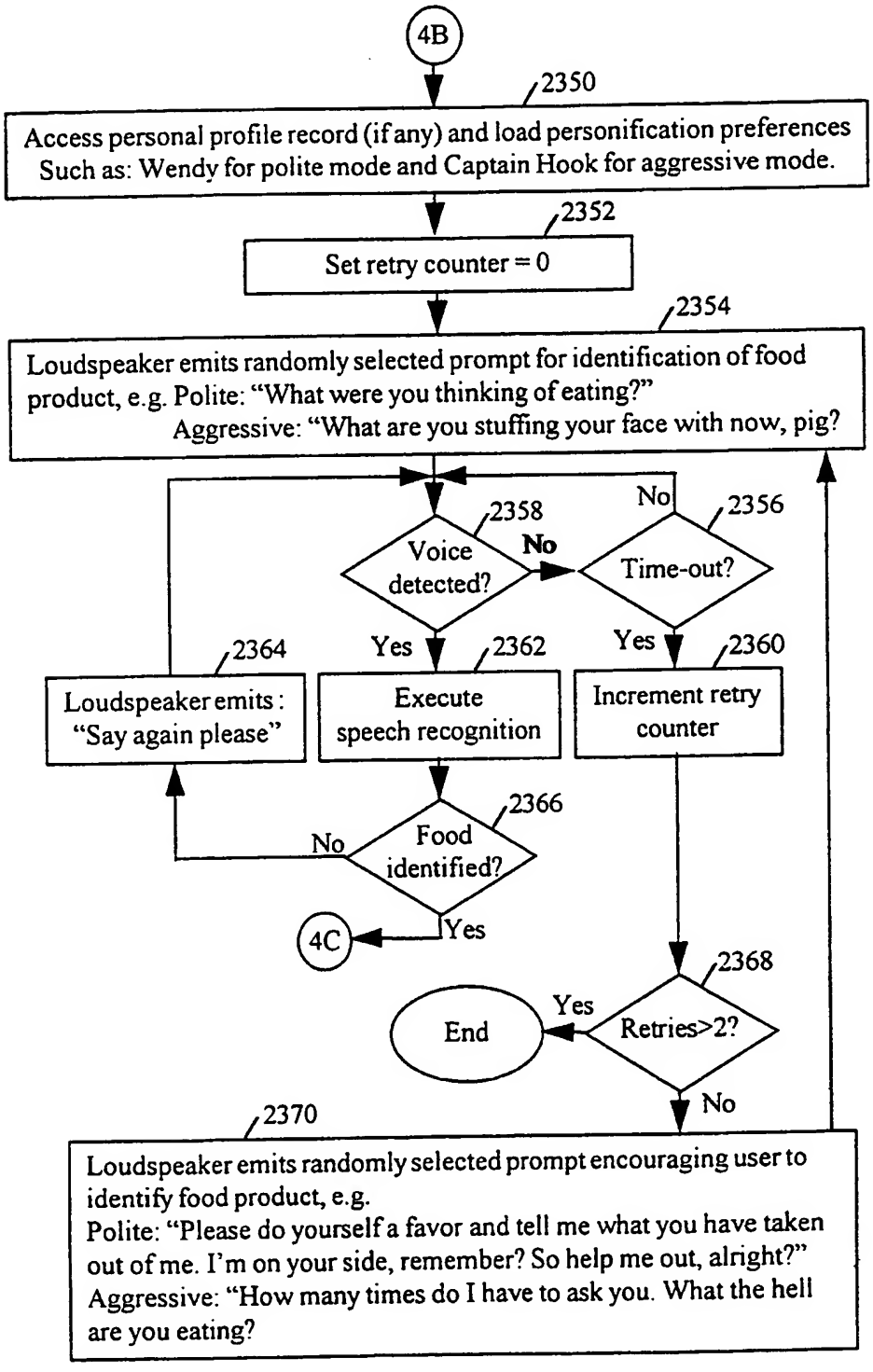


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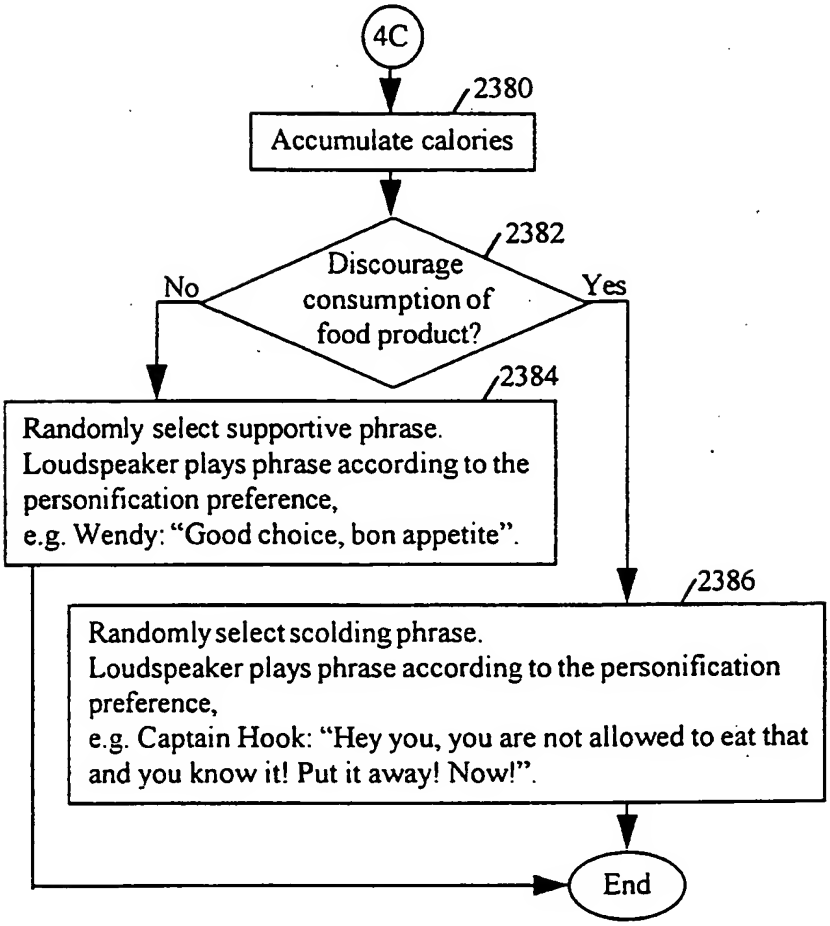
FIGURE 36C



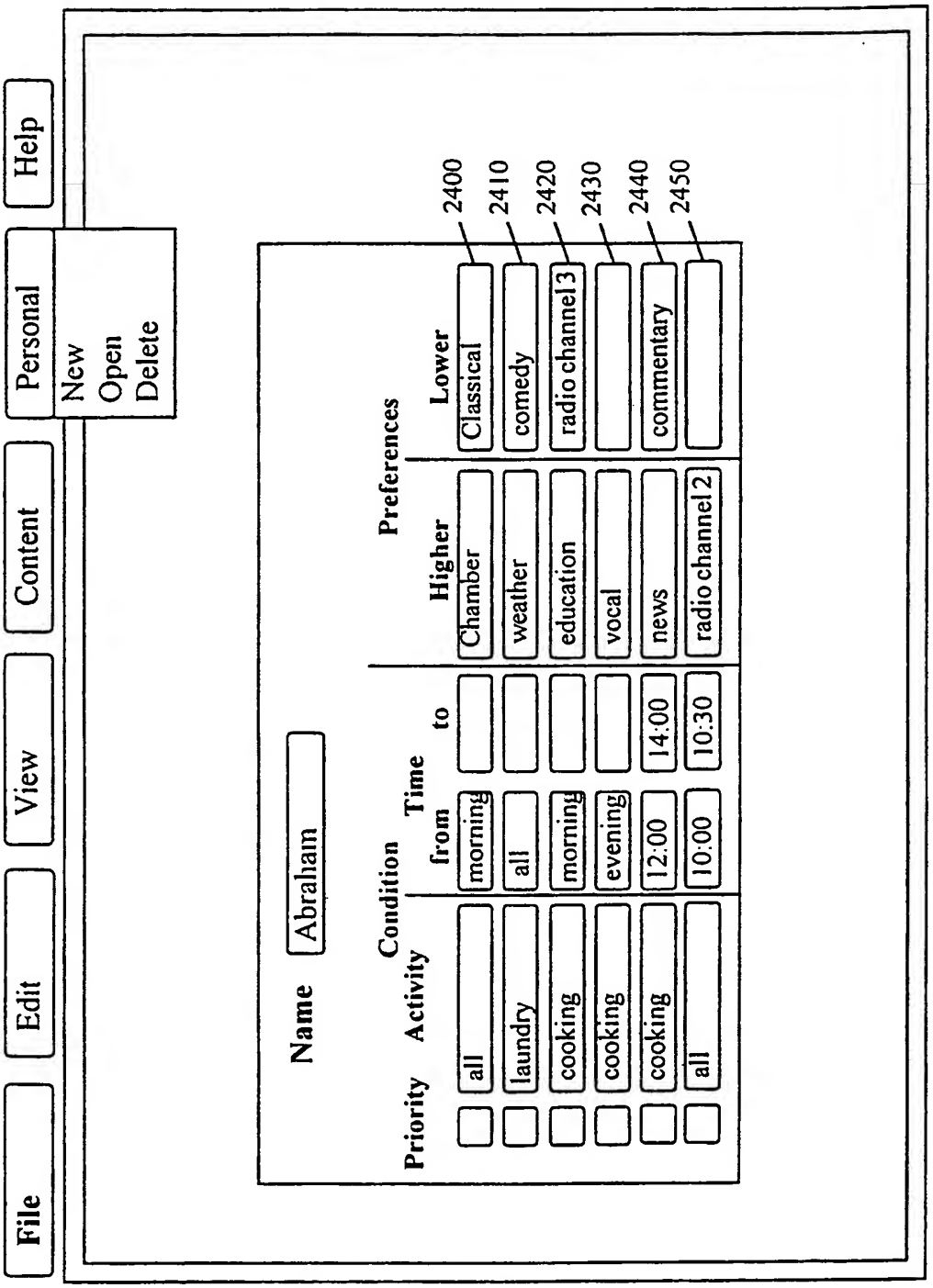

File
Edit
View
Content
Personal
Help
New
Open
Delete
Name
Abraham
Preferences
Condition
Time
Priority
Activity
from
to
Higher
Lower
all
morning
Chamber
Classical
2400
laundry
all
weather
comedy
2410
cooking
morning
education
radio channel 3
2420
cooking
evening
vocal
2430
cooking
12:00
14:00
news
commentary
2440
all
10:00
10:30
radio channel 2
2450

FIGURE 37

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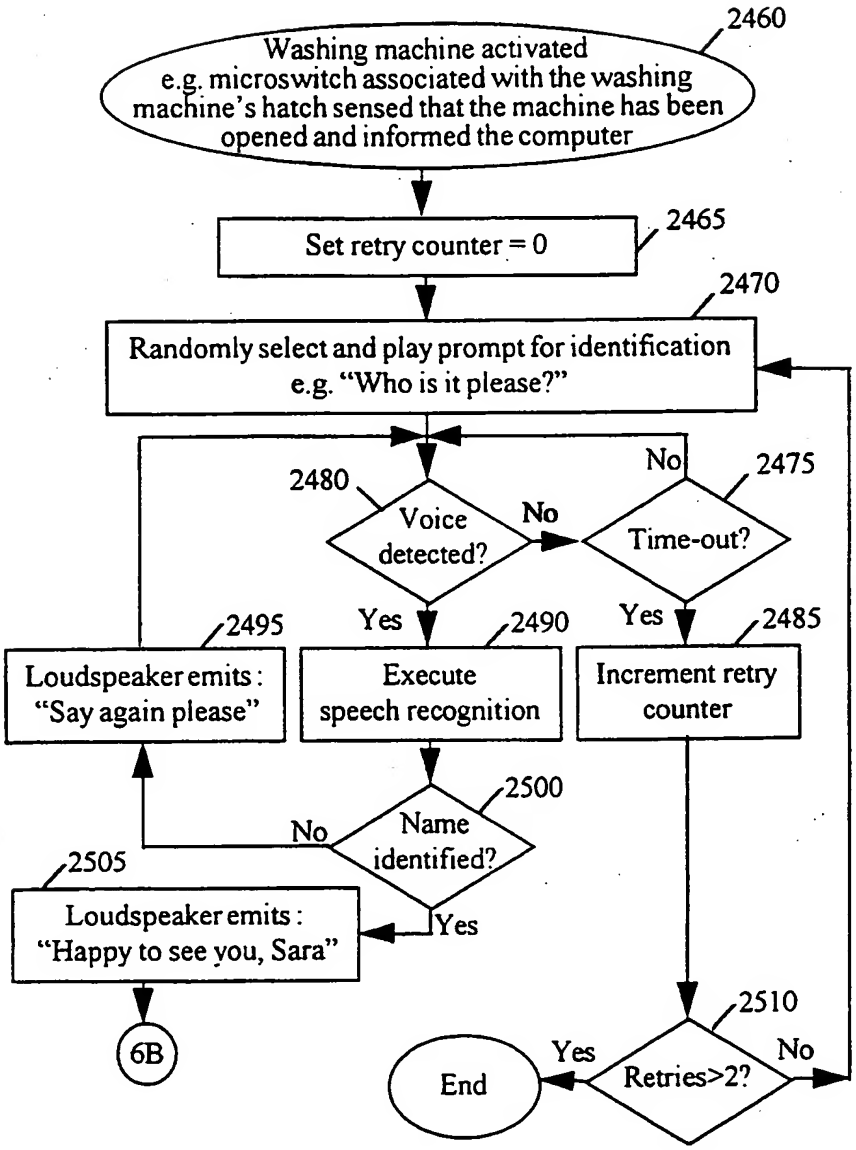
FIGURE 38A



131 /150
FIGURE 38B

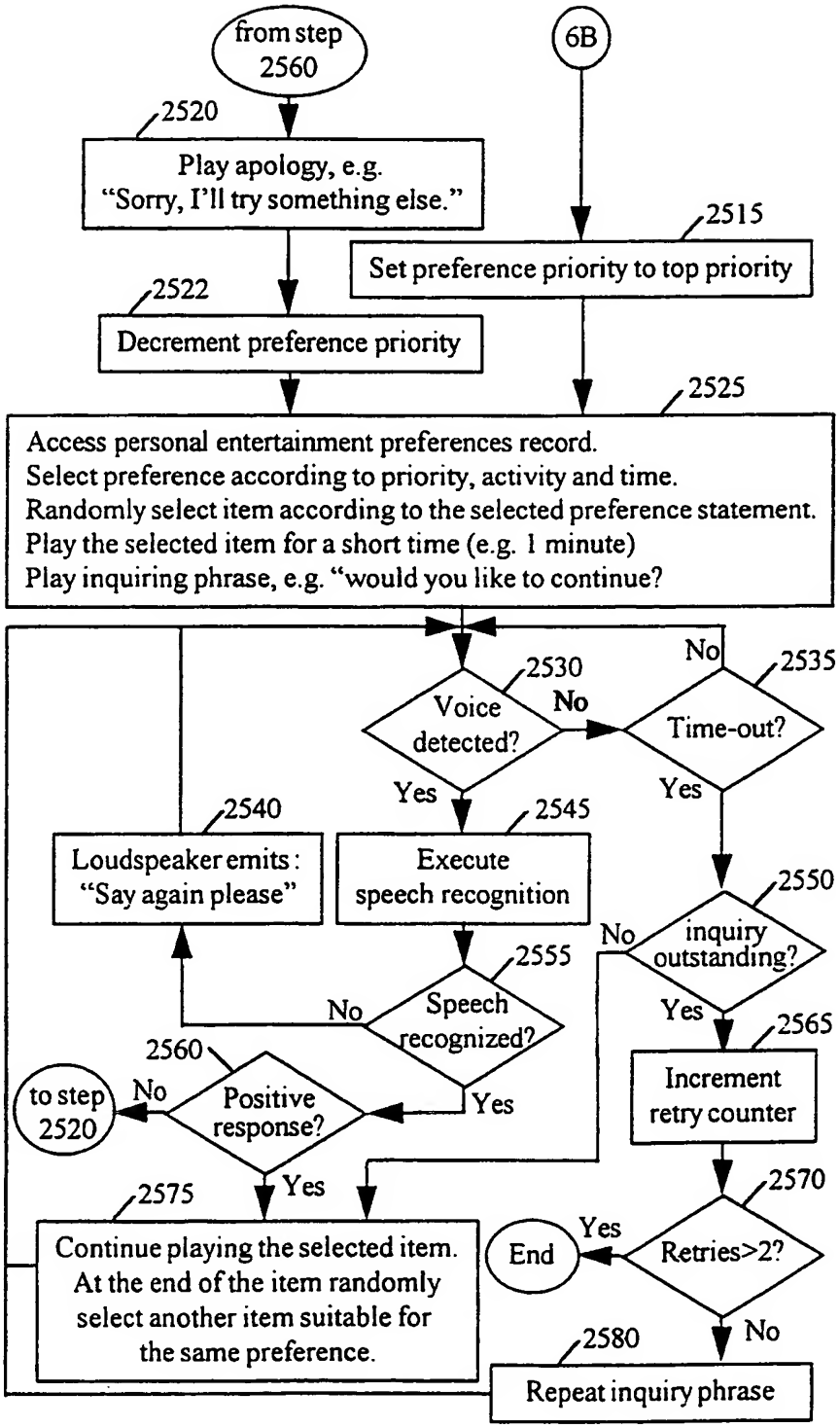


FIGURE 39

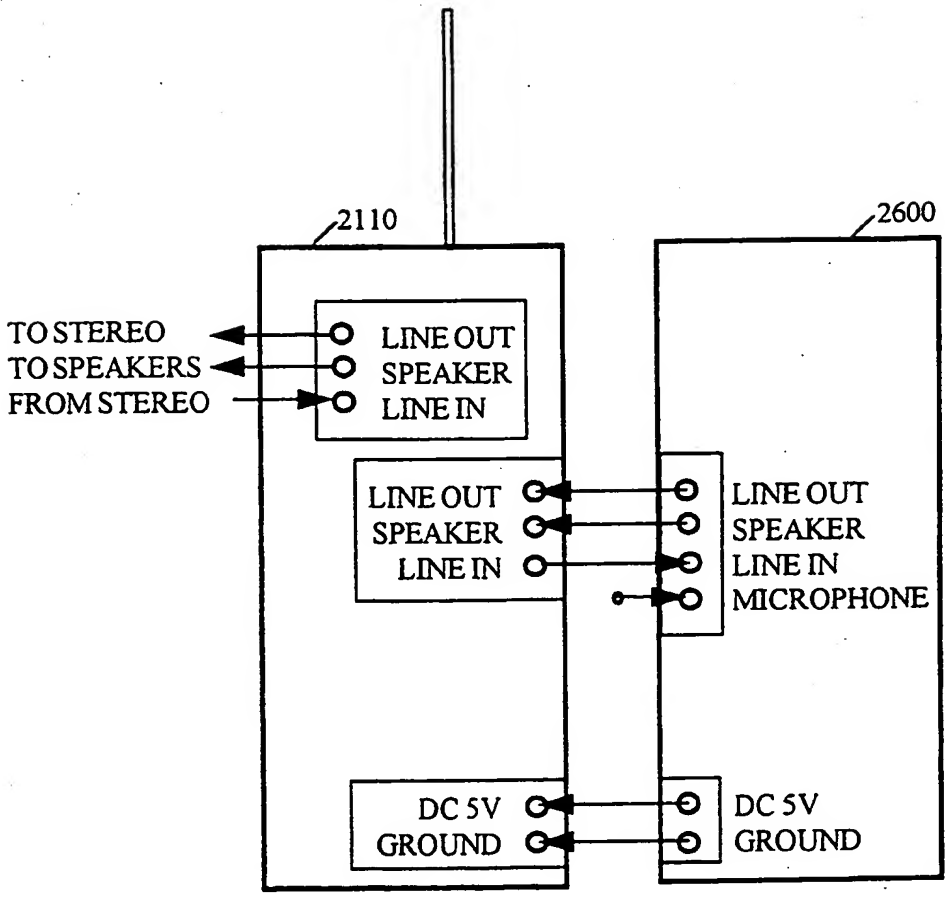

2110
2600
TO STEREO
TO SPEAKERS
FROM STEREO
LINE OUT
SPEAKER
LINE IN
LINE OUT
SPEAKER
LINE IN
LINE OUT
SPEAKER
LINE IN
MICROPHONE
DC 5V
GROUND
DC 5V
GROUND

FIGURE 40

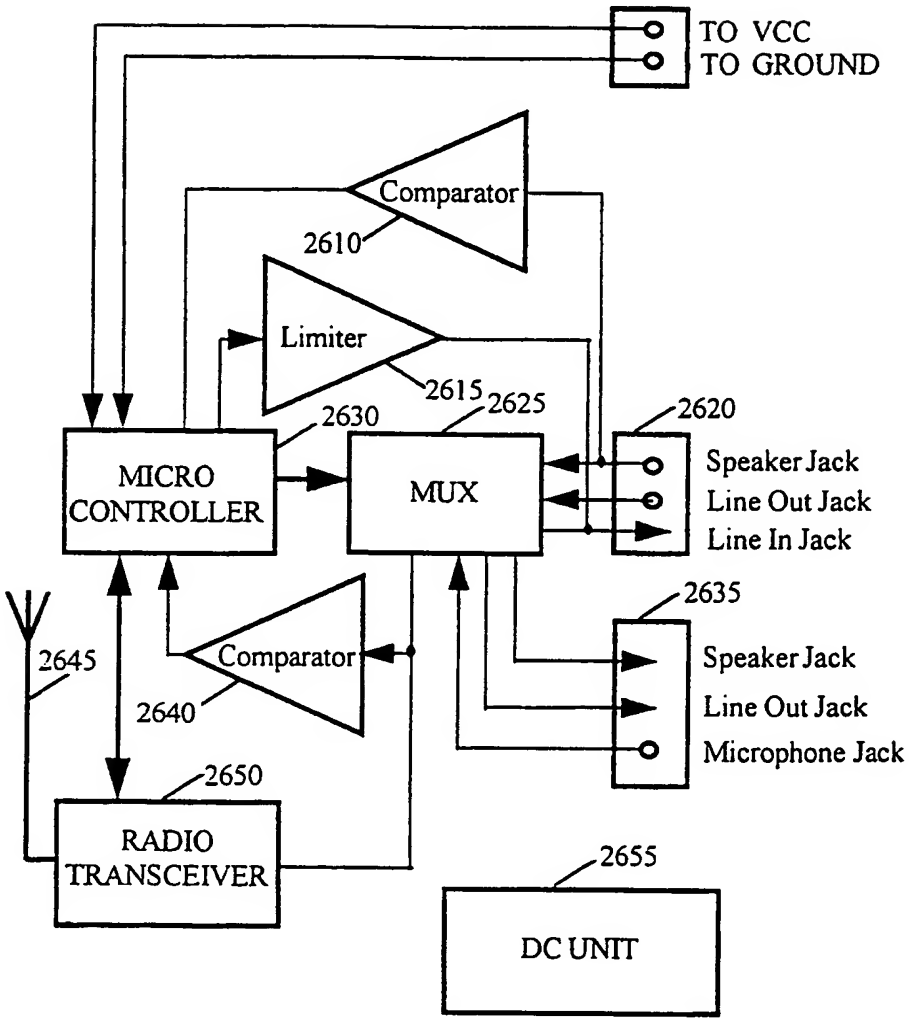

TO VCC
TO GROUND
Comparator
2610
Limiter
2615
2625
2630
2620
MICRO CONTROLLER
MUX
Speaker Jack
Line Out Jack
Line In Jack
2635
2645
Comparator
2640
Speaker Jack
Line Out Jack
Microphone Jack
2650
RADIO TRANSCEIVER
2655
DC UNIT

FIGURE 41

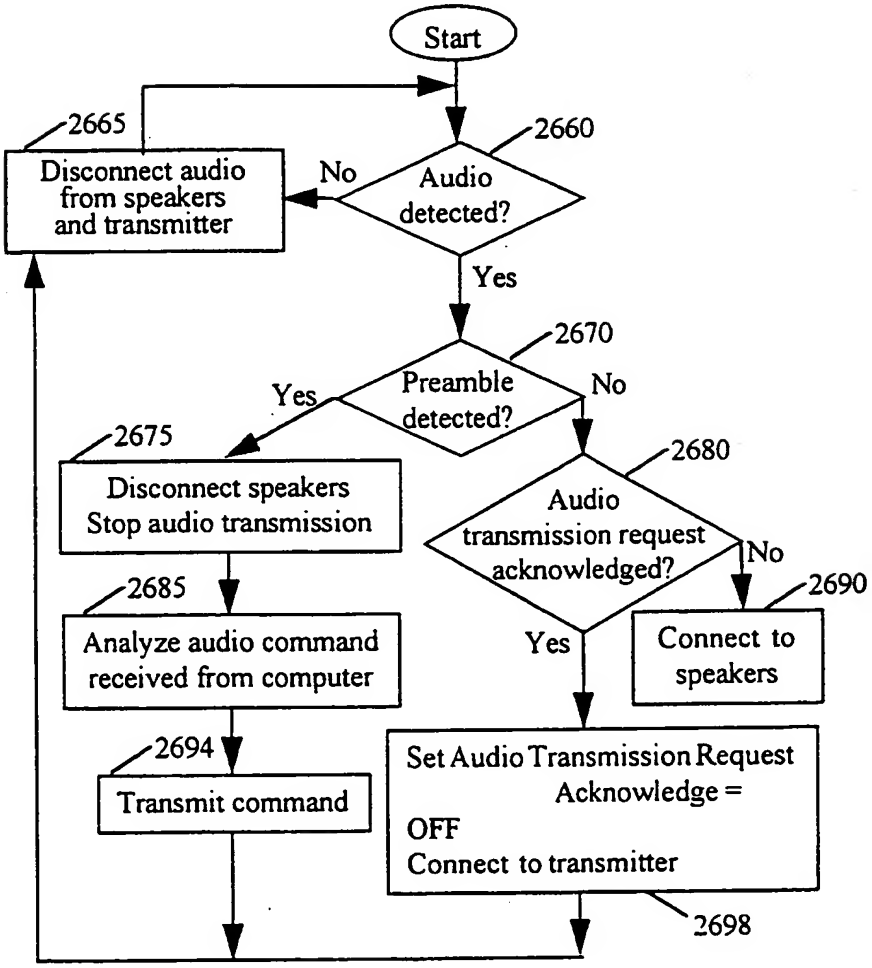

Start
2665
Disconnect audio from speakers and transmitter
No
2660
Audio detected?
Yes
2670
Preamble detected?
Yes
No
2675
Disconnect speakers Stop audio transmission
2680
Audio transmission request acknowledged?
No
2690
Connect to speakers
Yes
2685
Analyze audio command received from computer
2694
Transmit command
Set Audio Transmission Request Acknowledge =
OFF
Connect to transmitter
2698

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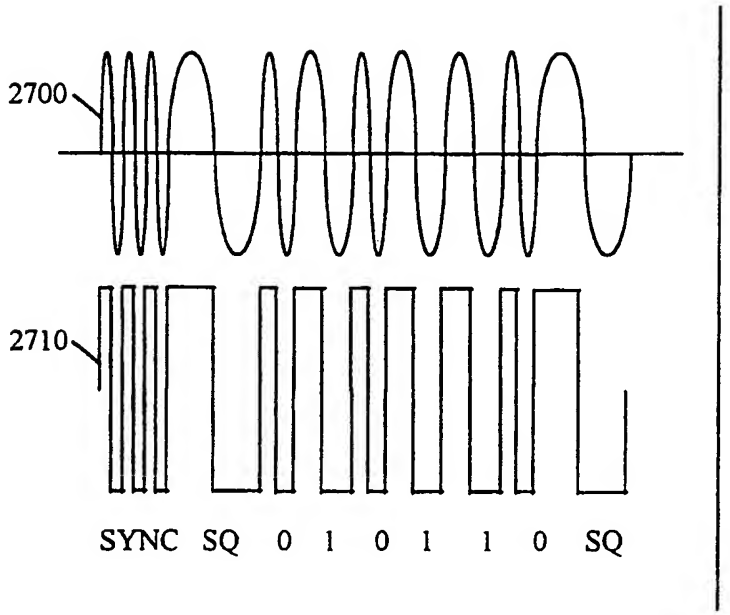
FIGURE 42



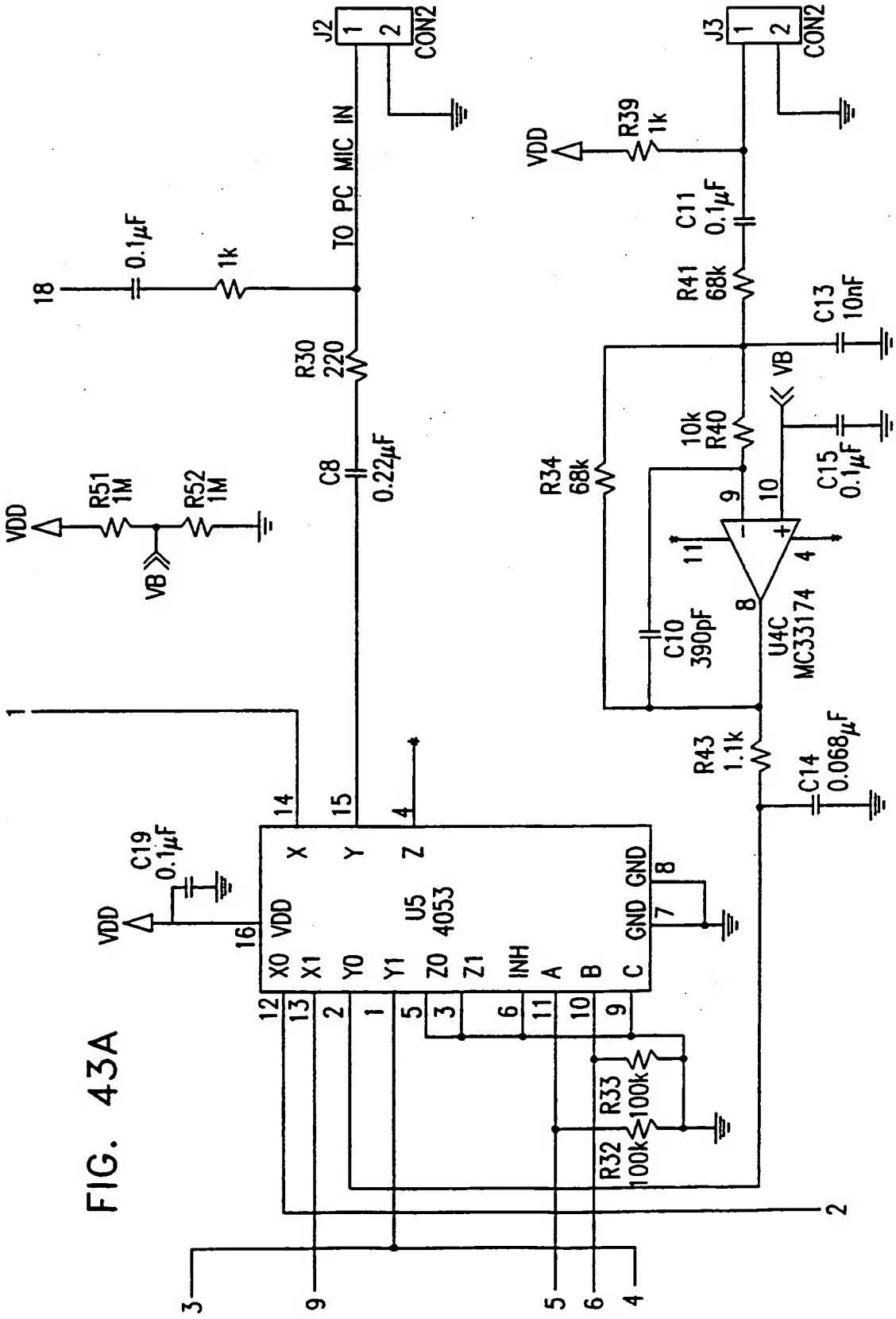

J2
CON2
TO PC MIC IN
18
0.1µF
1k
R30
220
C8
0.22µF
VDD
R51
1M
R52
1M
VB
J3
CON2
VDD
R39
1k
C11
0.1µF
R41
68k
C13
10nF
R34
68k
10k
R40
VB
C15
0.1µF
C10
390pF
U4C
MC33174
R43
1.1k
C14
0.068µF
C19
0.1µF
VDD
U5
4053
VDD
X
Y
Z
GND
GND
XO
X1
YO
Y1
ZO
Z1
INH
A
B
C
R33
100k
R32
100k

FIG. 43A

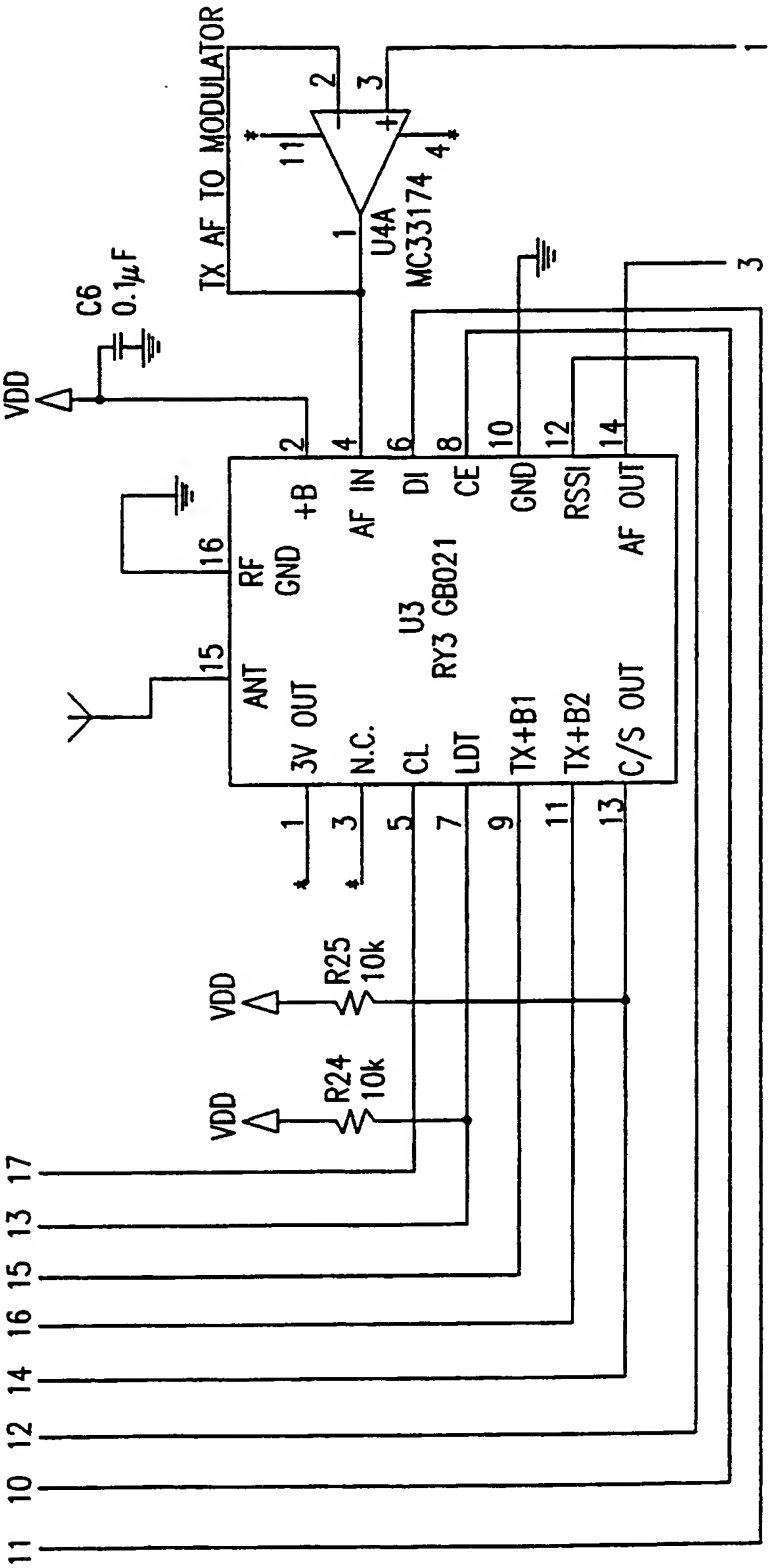

TX AF TO MODULATOR
U4A
MC33174
C6
0.1µF
VDD
U3
RY3 GB021
RF GND
+B
AF IN
DI
CE
GND
RSSI
AF OUT
ANT
3V OUT
N.C.
CL
LDT
TX+B1
TX+B2
C/S OUT
R25
10k
R24
10k

FIG. 43B

FIG. 43C

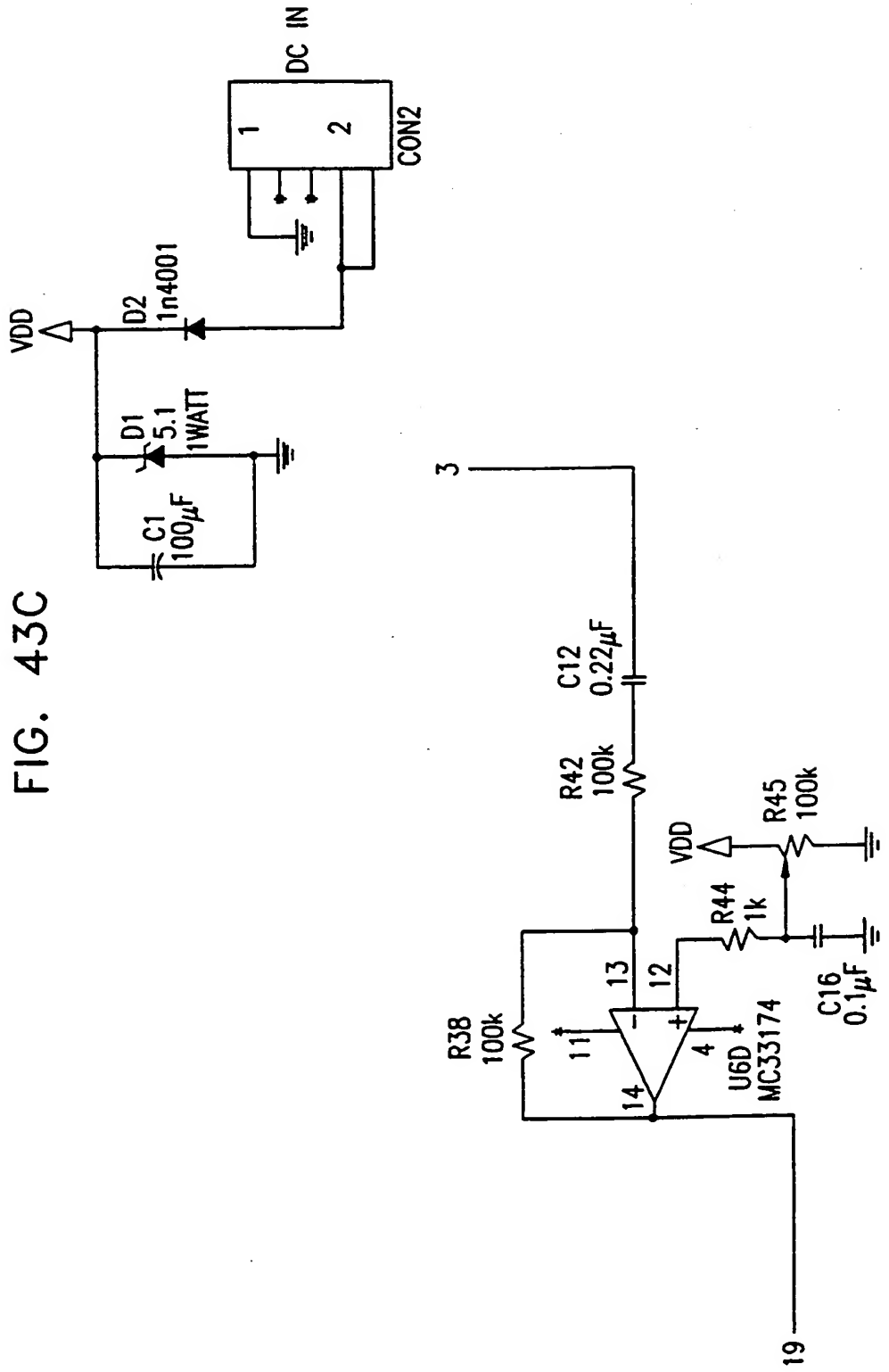
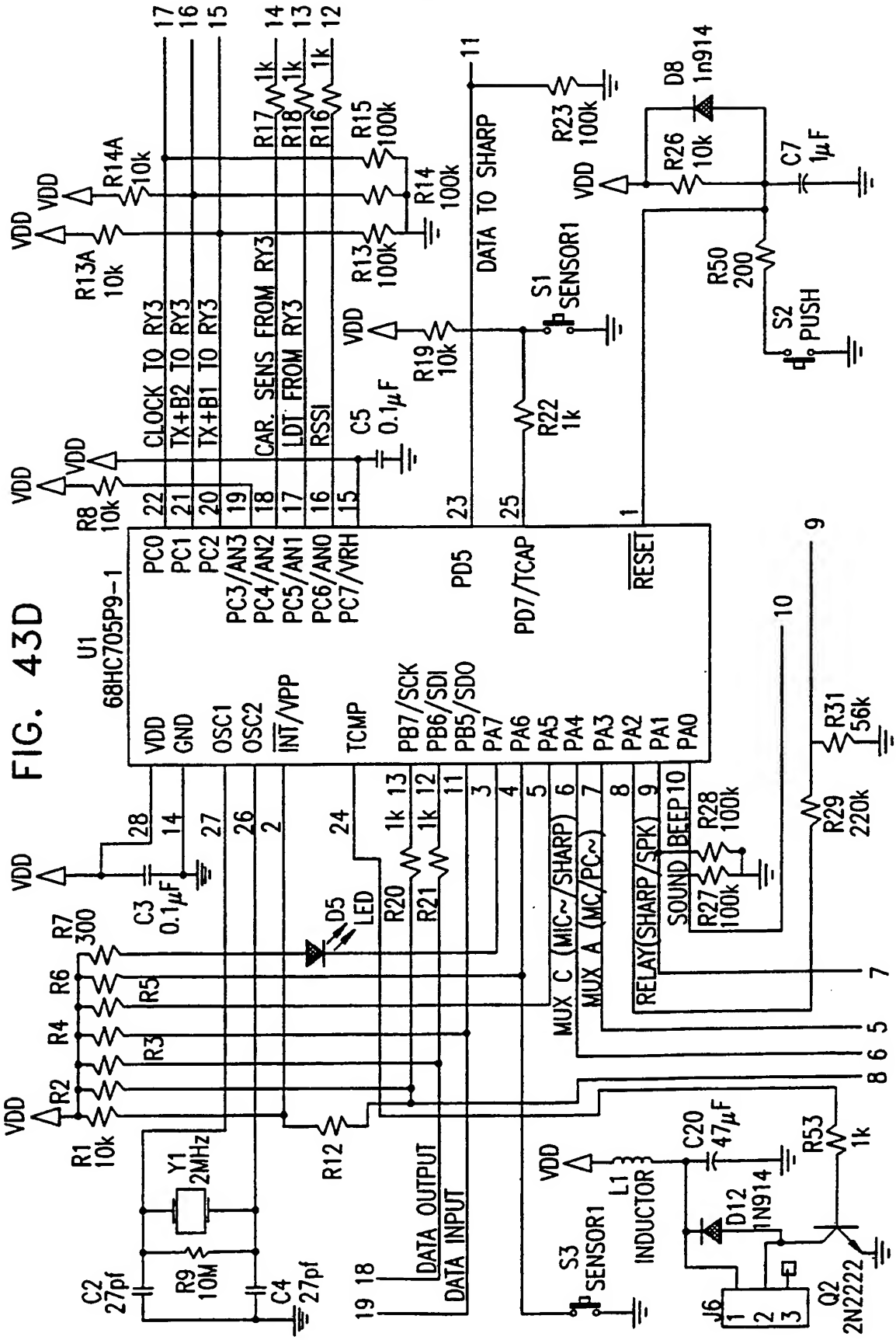

DC IN
1
2
CON2
VDD
D2
1n4001
D1
5.1
1WATT
C1
100µF
3
C12
0.22µF
R42
100k
R45
100k
VDD
R44
1k
C16
0.1µF
R38
100k
13
12
11
4
14
U6D
MC33174
19

FIG. 43D


U1
68HC705P9-1
VDD
GND
OSC1
OSC2
INT/VPP
TCMP
PB7/SCK
PB6/SDI
PB5/SDO
PA7
PA6
PA5
PA4
PA3
PA2
PA1
PA0
PC0
PC1
PC2
PC3/AN3
PC4/AN2
PC5/AN1
PC6/AN0
PC7/VRH
PD5
PD7/TCAP
RESET
CLOCK TO RY3
TX+B2 TO RY3
TX+B1 TO RY3
CAR. SENS FROM RY3
LDT FROM RY3
RSSI
DATA TO SHARP
DATA OUTPUT
DATA INPUT
MUX C (MIC~/SHARP)
MUX A (MC/PC~)
RELAY(SHARP/SPK)
SOUND
BEEP
R1 10k
R2
R3
R4
R5
R6
R7 300
R8 10k
R9 10M
R12
R13 100k
R13A 10k
R14 100k
R14A 10k
R15 100k
R16 1k
R17 1k
R18 1k
R19 10k
R20 1k
R21 1k
R22 1k
R23 100k
R26 10k
R27 100k
R28 100k
R29 220k
R31 56k
R50 200
R53 1k
C2 27pf
C3 0.1µF
C4 27pf
C5 0.1µF
C7 1µF
C20 47µF
Y1 2MHz
D5 LED
D8 1n914
D12 1N914
L1 INDUCTOR
S1 SENSOR1
S2 PUSH
S3 SENSOR1
J6
Q2 2N2222

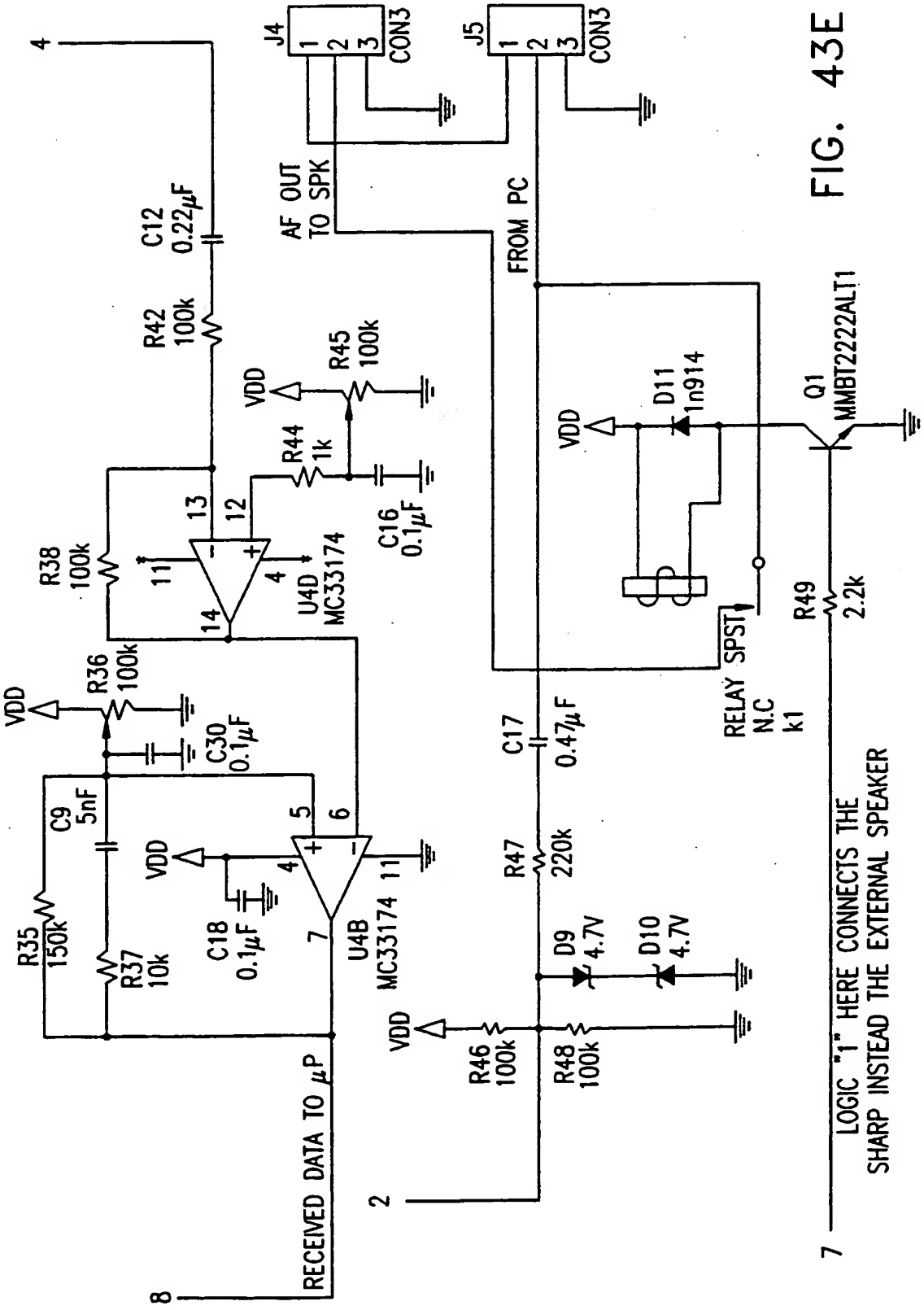

4
J4
CON3
J5
CON3
AF OUT TO SPK
FROM PC
C12 0.22µF
R42 100k
R45 100k
VDD
R44 1k
C16 0.1µF
R38 100k
U4D MC33174
R36 100k
C30 0.1µF
C9 5nF
R35 150k
R37 10k
C18 0.1µF
U4B MC33174
RECEIVED DATA TO µP
8
C17 0.47µF
R47 220k
D9 4.7V
D10 4.7V
R46 100k
R48 100k
2
D11 1n914
Q1 MMBT2222ALT1
RELAY SPST
N.C
k1
R49 2.2k
LOGIC "1" HERE CONNECTS THE SHARP INSTEAD THE EXTERNAL SPEAKER
7

FIG. 43E

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FIGURE 44

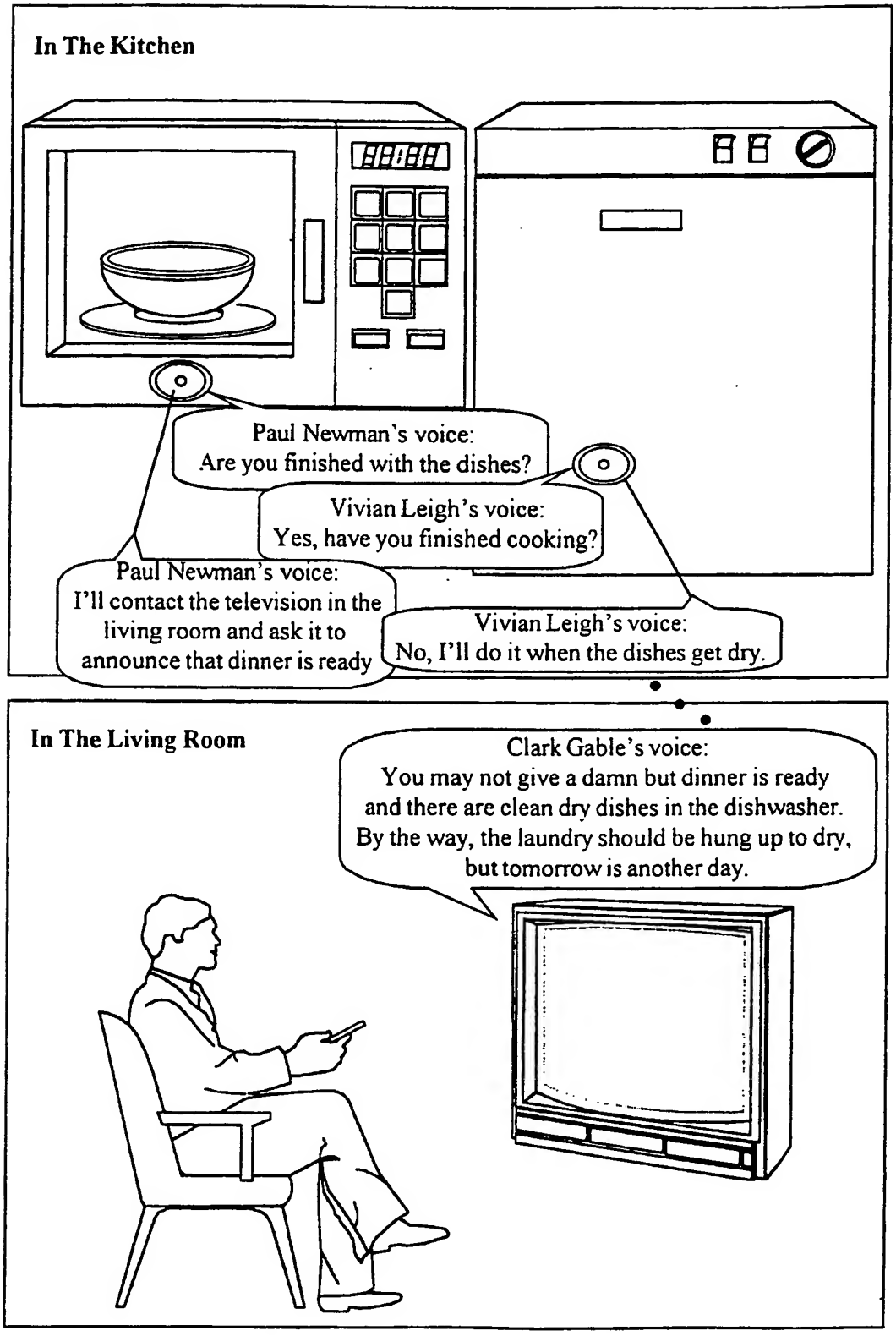

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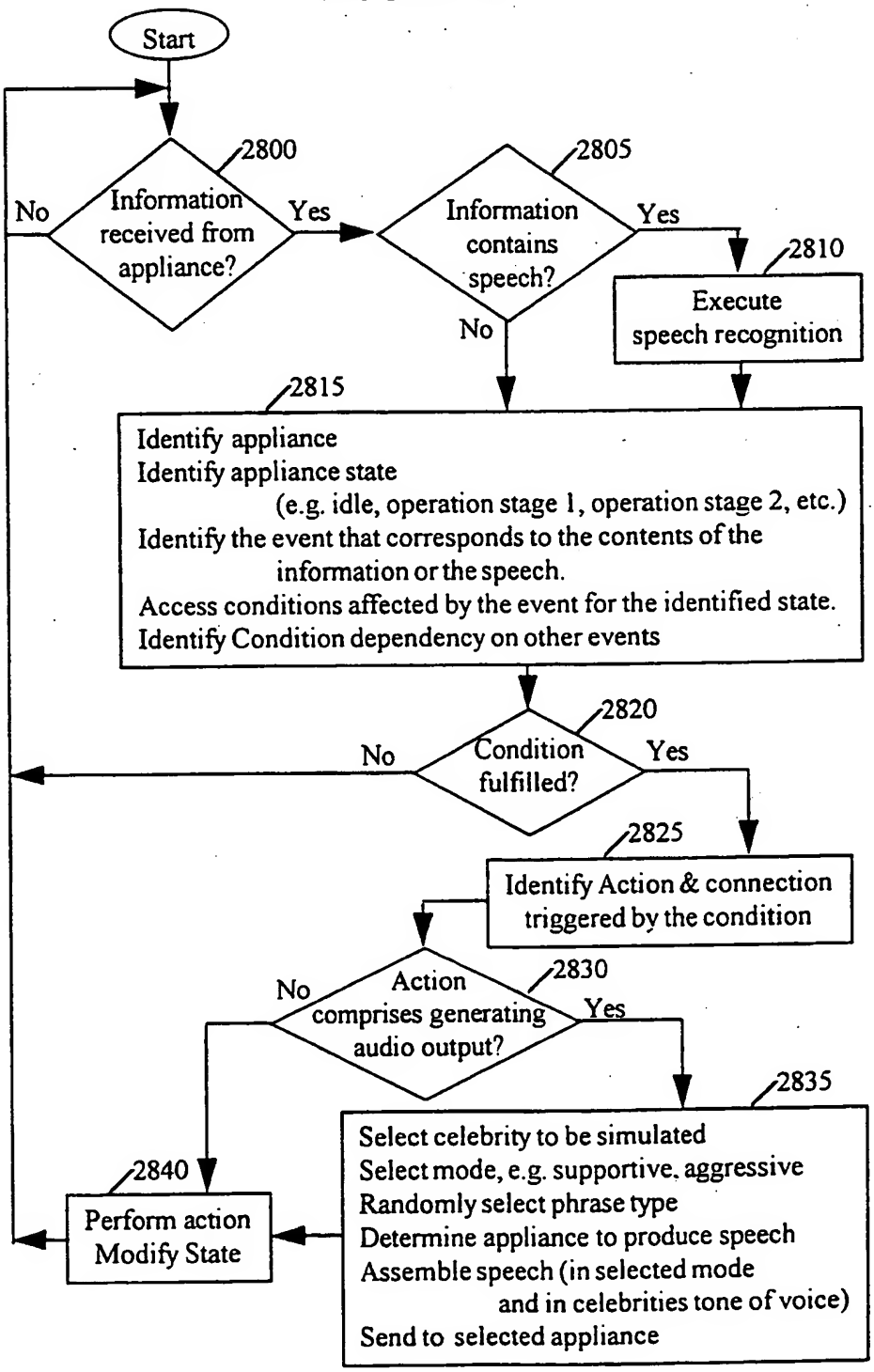
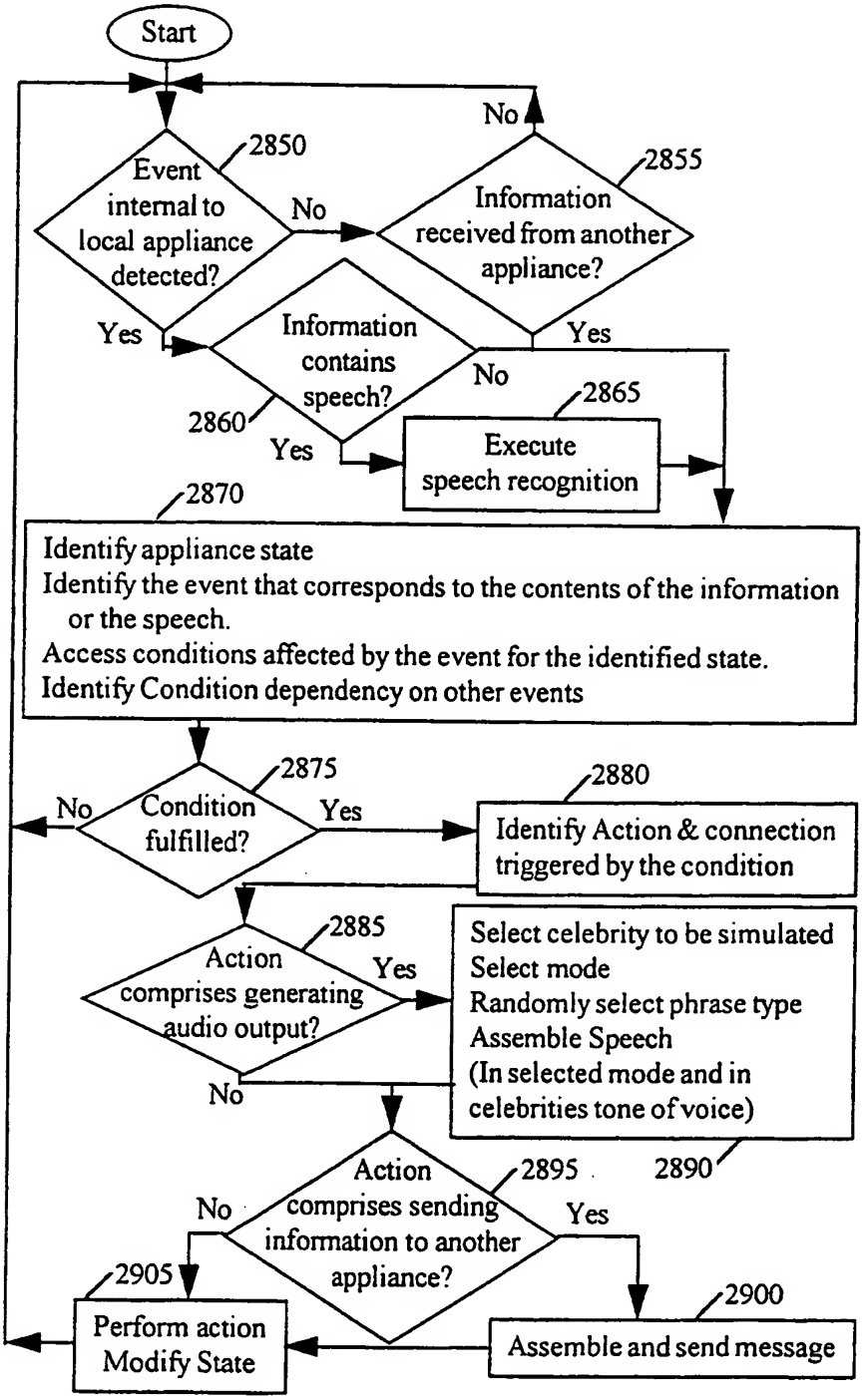
FIGURE 45



143 /150
FIGURE 46



144 /150
FIGURE 47

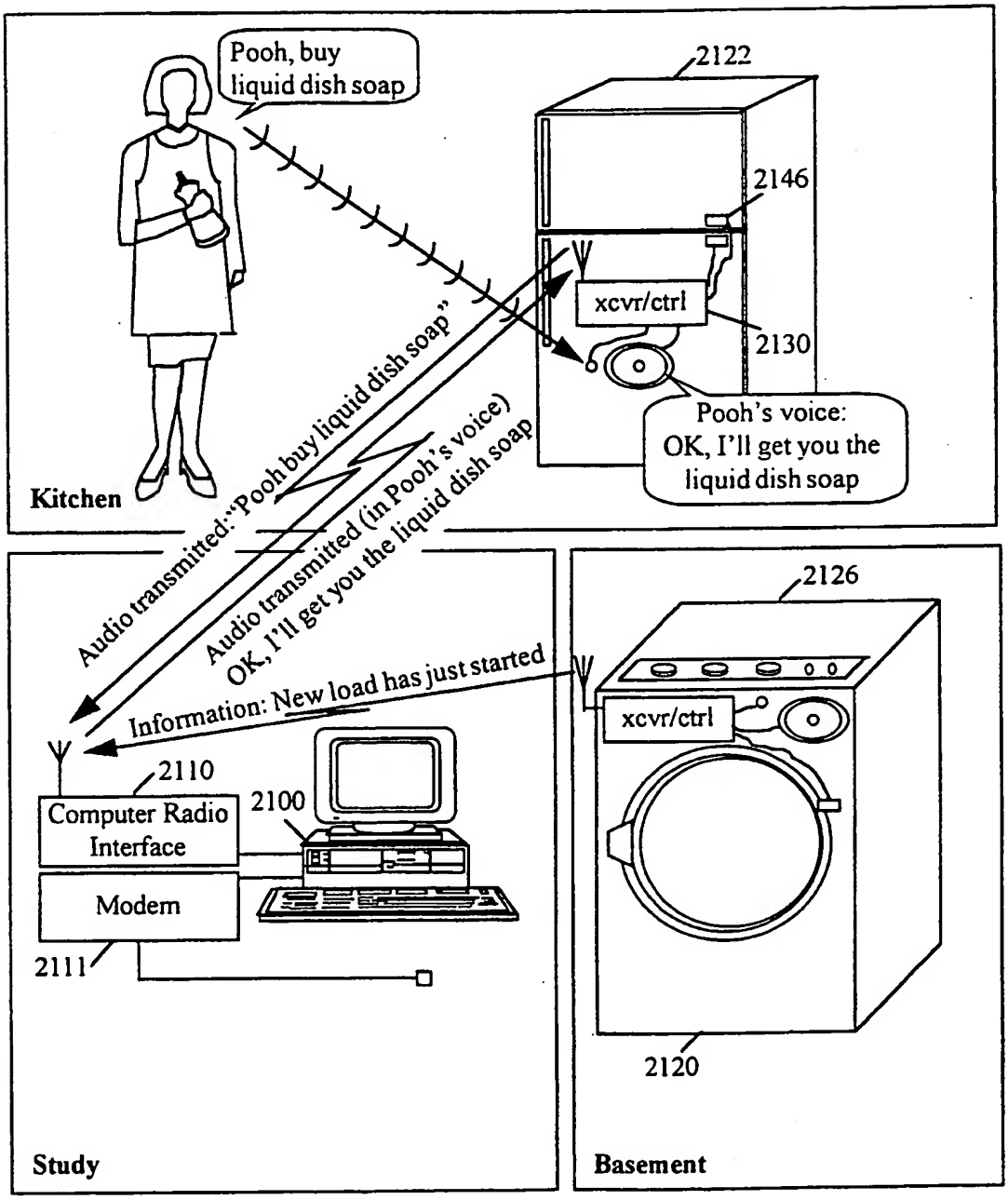


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FIGURE 48

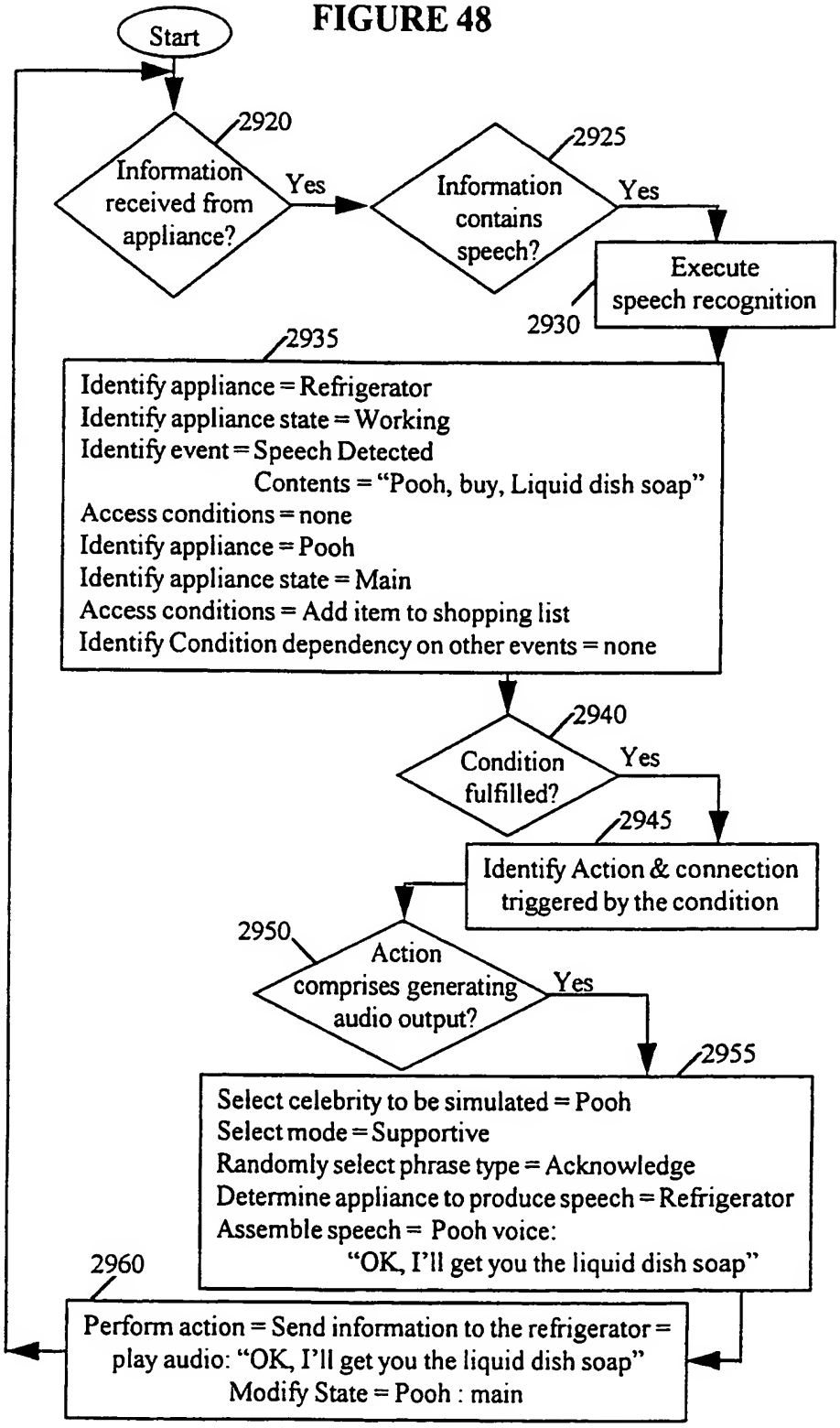

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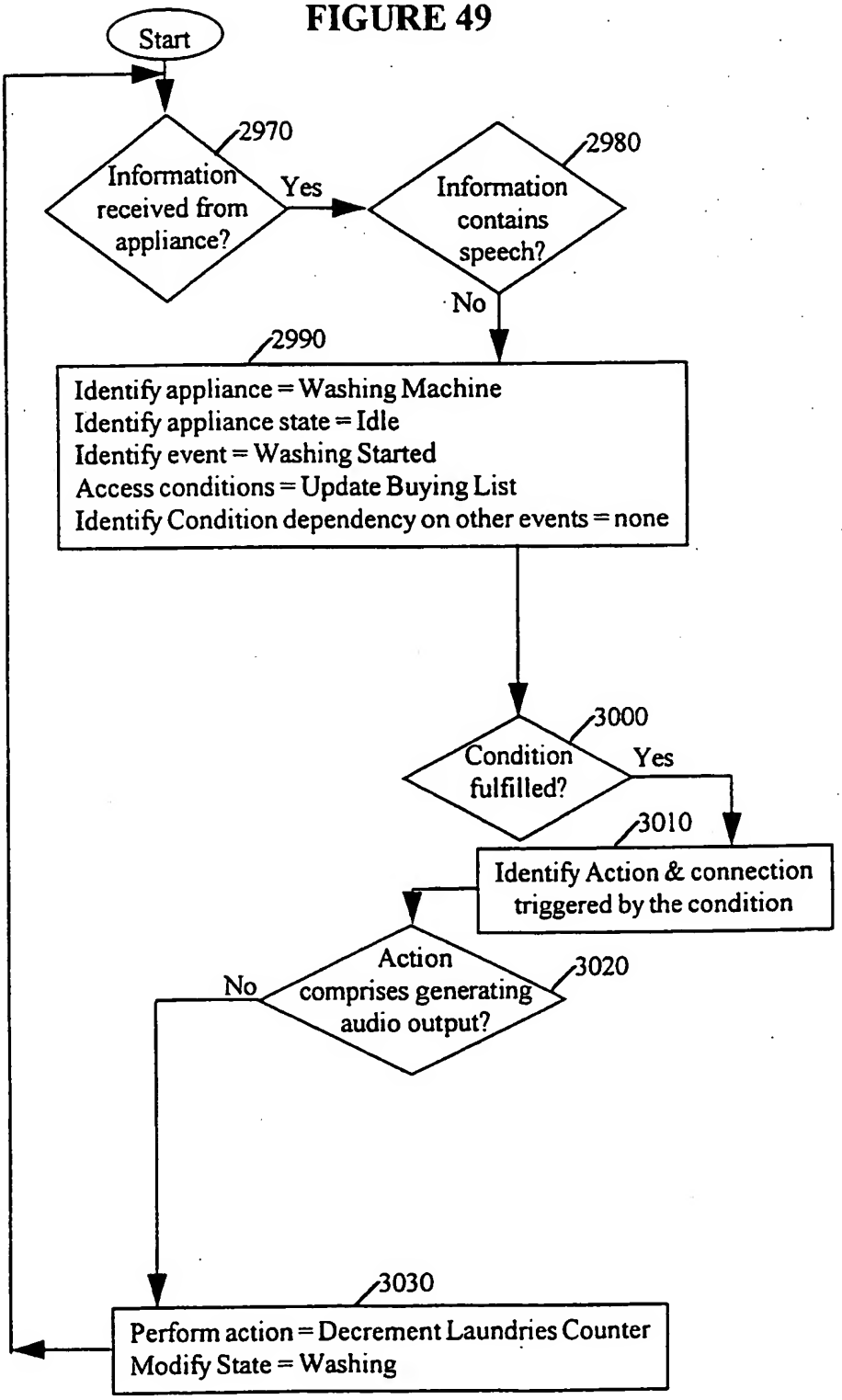
FIGURE 49



147 /150
FIGURE 50

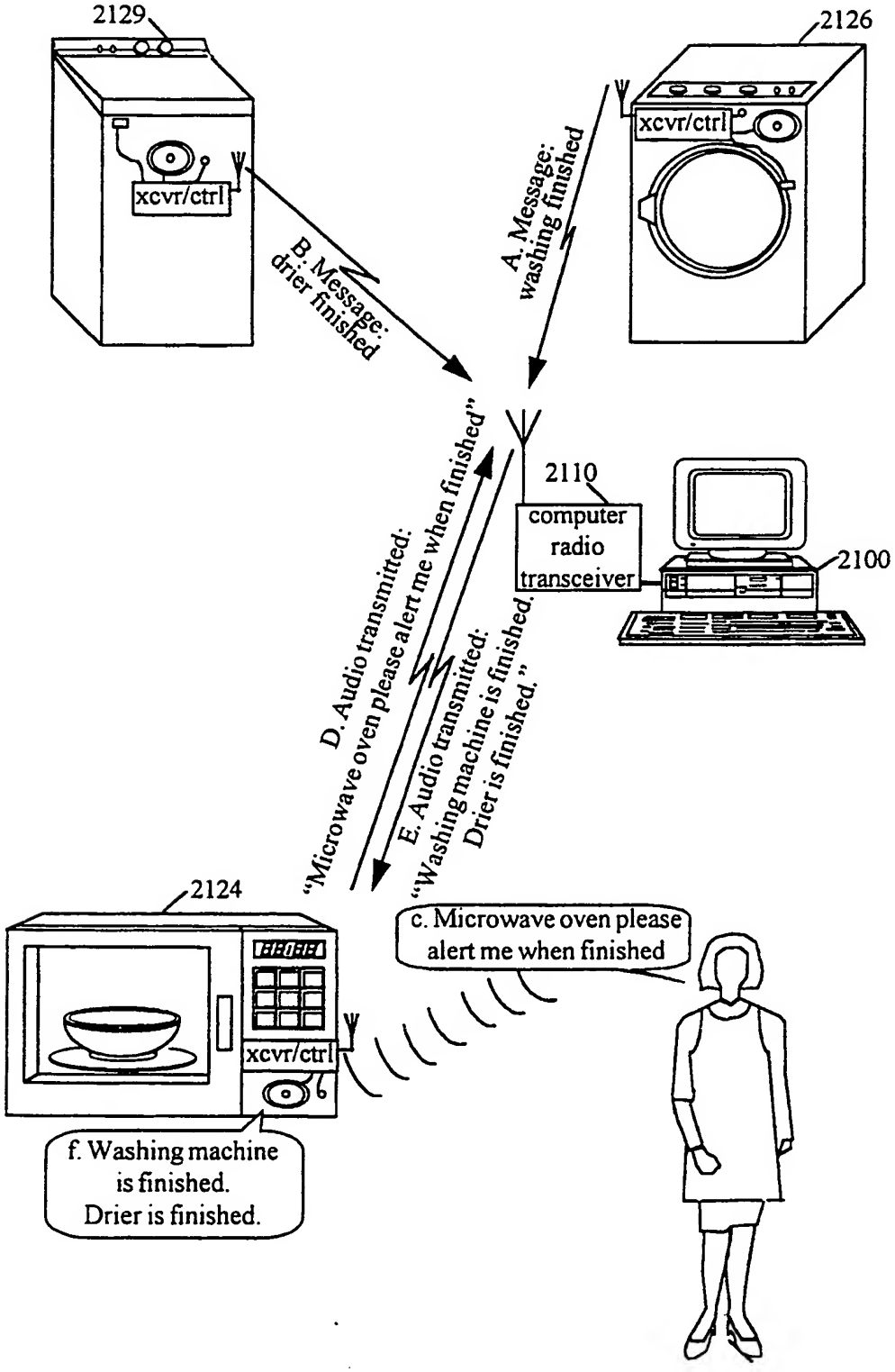


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FIGURE 51

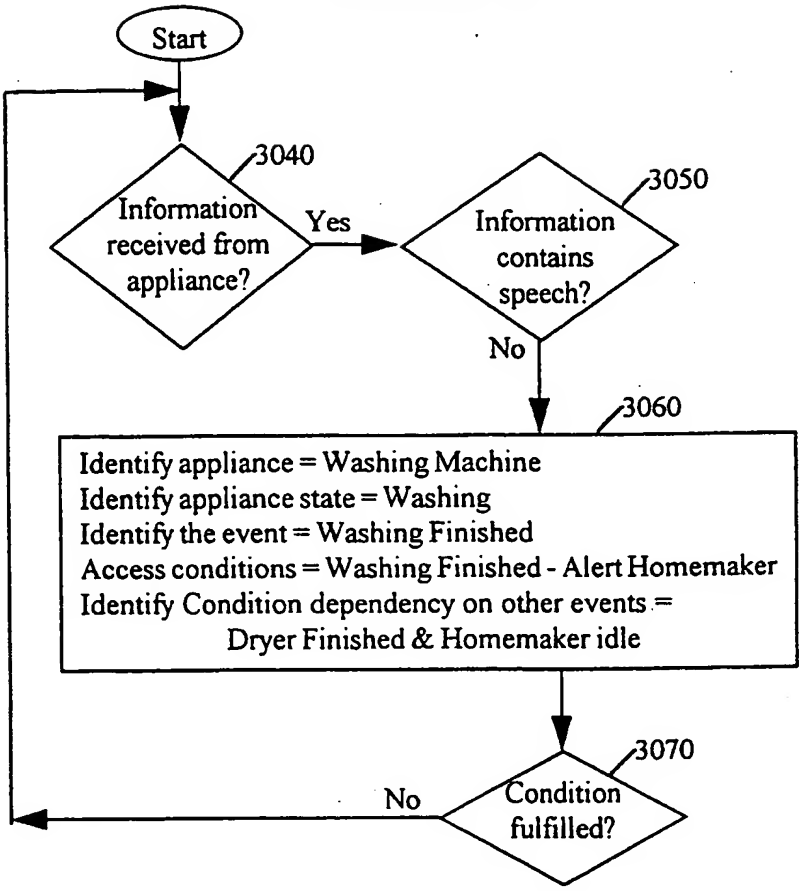

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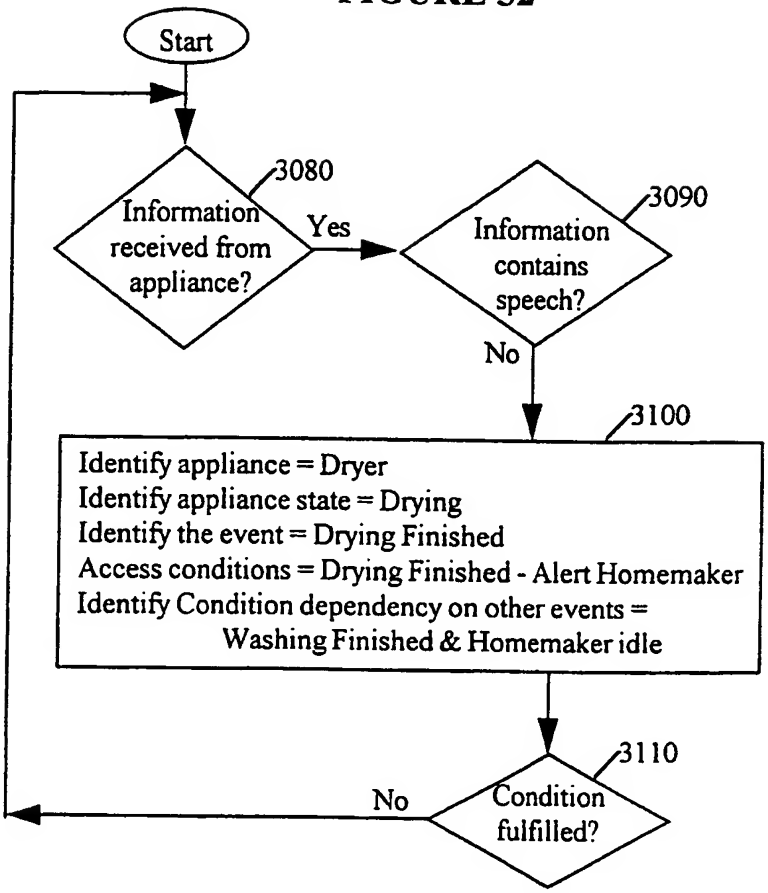
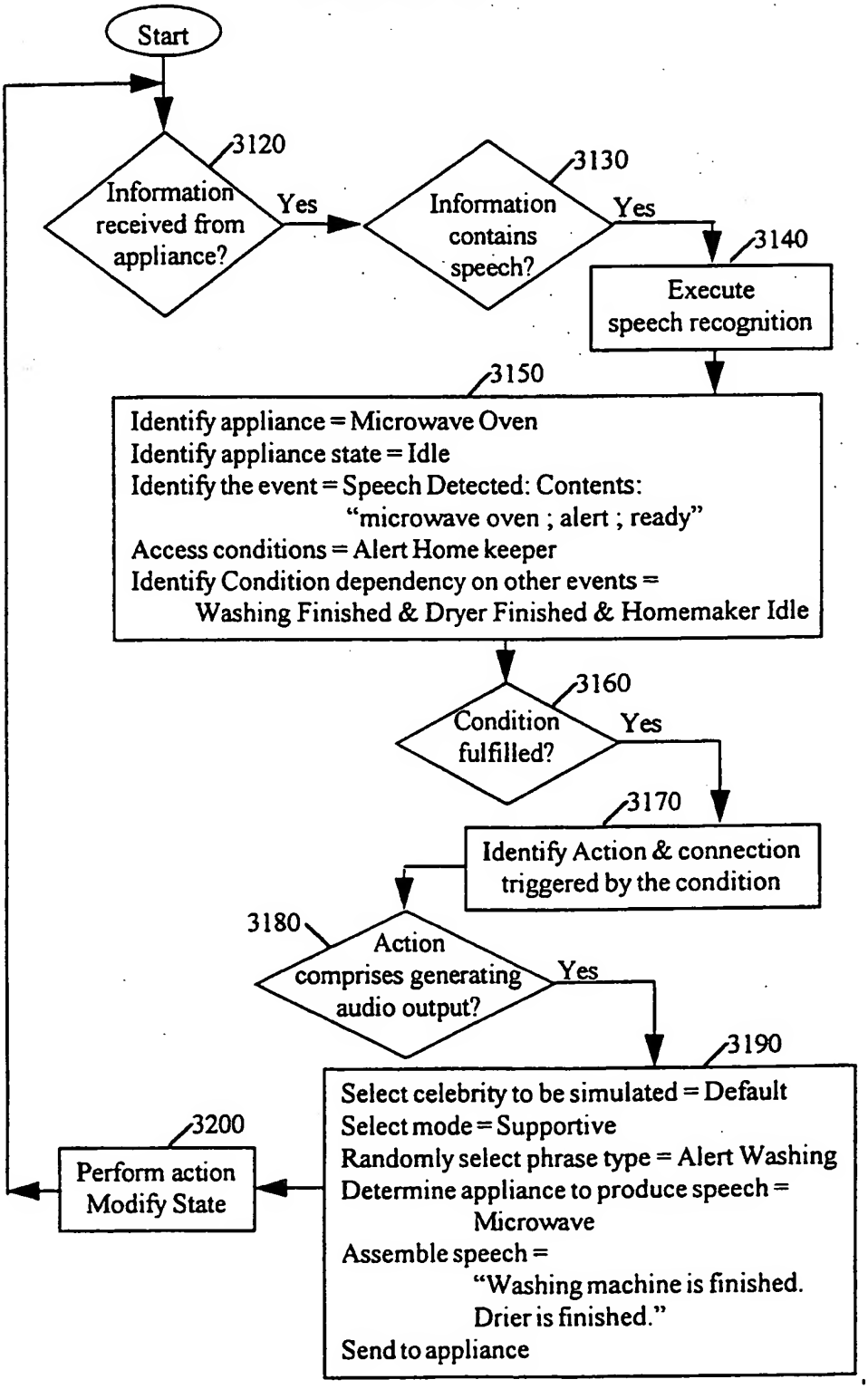
FIGURE 52



150 /150
FIGURE 53



INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL98/00223

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :Please See Extra Sheet.
US CL : 369/19,367/198
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 369/19,367/198

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS, s remote control (p) voice control and computer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 4,520,576 (Vander Molen) 4 Jun, 1985, abstract,fig. 1 & col. 2, lines 15-68, & col. 4, lines 1-53).	2-13,18 ,21-23. --- 16,17
Y	US 5,712,834 (NAGANO et al) 27 Jan 1998, fig. 1, abstract, & col. 4, lines 9-42.	16,17.
Y	US 5,712,834 (NAGANO et al) 27 Jan. 1998, fig. 1, abstract, & col. 4, lines 9-12	1,14,15,19,20,24-26.
Y	US 4,520,576 (VANDER MOLEN) 4 June 1985, fig. 1,col. 2, lines 15-68, & col. 4, line 1-53.	1,14,15,19,20,24-26.

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 AUGUST 1998	13 OCT 1998

Name and mailing address of the ISA/US	Authorized officer
Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231	ANTHONY A. ASONGWED
Facsimile No. (703) 305-3230	Telephone No. (703) 305-3900

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL98/00223

A. CLASSIFICATION OF SUBJECT MATTER:
IPC (6):

G11B 31/00; G10K 11/00

Rosiglitazone Budget					
		Low		High	
	Rate	Hours	Fees	Hours	Fees
Lynch, Francis	675	50	$33,750.00	120	$81,000.00
Gill, Laurie	575	125	$71,875.00	160	$92,000.00
Blais, Elaine	500	25	$12,500.00	50	$25,000.00
Bennett, John	430	100	$43,000.00	185	$79,550.00
Subramanyam, Sundar	335	50	$16,750.00	160	$53,600.00
Vermut, Don	300	100	$30,000.00	160	$48,000.00
Leach, Justine	205	50	$10,250.00	75	$15,375.00
Budris, Kevin	140	100	$14,000.00	160	$22,400.00
Lemke, Scott	150	75	$11,250.00	100	$15,000.00
		Total	$243,375.00	Total	$431,925.00